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ABSTRACT

This document is designed to assist classroom teachers in preparing students to successfully complete the Alabama High School Graduation Exam (AHSGE). It consists of activities that are correlated with the Alabama Course of Study: Mathematics, Bulletin 1997, No. 4, and Standards and Objectives (Reading Comprehension, Language, Mathematics, and Science) for the Alabama High School Graduation Exam, Bulletin 1997, No. 16. Activities include: (1) "Apply order of operations"; (2) "Add and subtract polynomials"; (3) "Multiply polynomials"; (4) "Factor polynomials"; (5) "Solve multi-step equations of first degree"; (6) "Solve quadratic equations that are factorable"; (7) "Solve systems of two linear equations"; (8) "Solve multi-step inequalities of first degree"; (9) "Identify functions"; (10) "Find the range of functions when given the domain"; (11) "Find the perimeter, circumference, area, or volume of geometric figures"; (12) "Find the distance, midpoint, or slope of line segments when given two points"; (13) "Graph or identify graphs of linear equations"; (14) "Graph lines given certain conditions"; (15) "Determine solution sets of inequalities"; (16) "Identify graphs of common relations"; (17) "Translate verbal or symbolic information into algebraic expressions, or identify equations or inequalities that represent graphs or problem situations"; (18) "Apply properties of angles and relationships between angles"; (19) "Apply Pythagorean Theorem"; (20) "Apply properties of similar polygons"; (21) "Apply properties of plane and solid geometric figures"; (22) "Determine measures of central tendency"; (23) "Determine probabilities"; (24) "Solve problems involving direct variation"; and (25) "Solve problems involving algebraic concepts." Possible reading and writing connections are also included in this document for each standard and objective of the mathematics subject-area test of the AHSGE. (MM)

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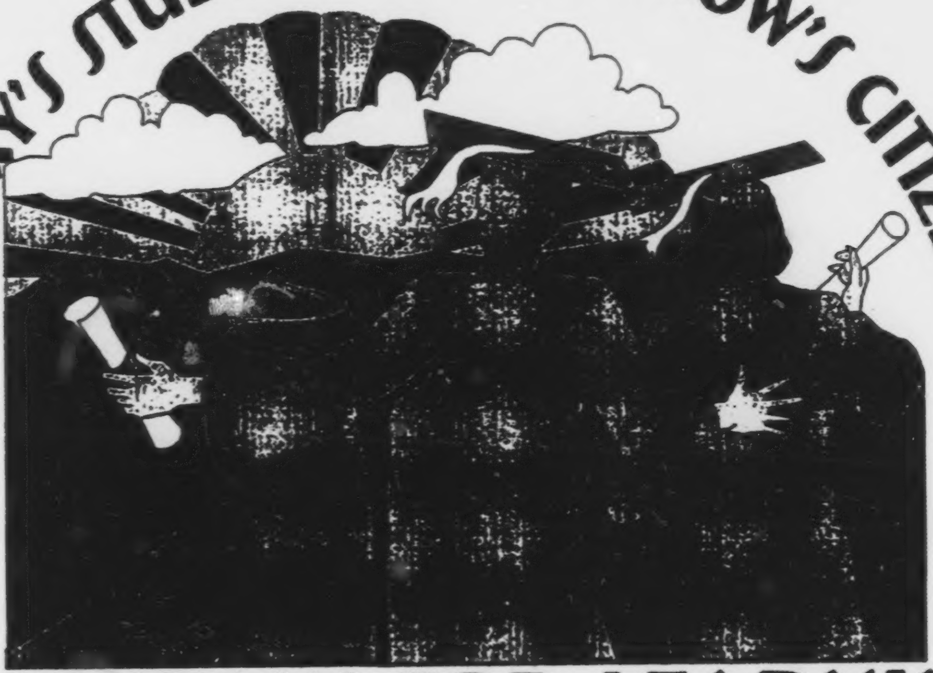
ALABAMA HIGH SCHOOL GRADUATION EXAM

ED 458 111

TODAY'S STUDENTS, TOMORROW'S CITIZENS



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ALABAMA HIGH SCHOOL GRADUATION EXAM

TODAY'S STUDENTS, TOMORROW'S CITIZENS PATHWAYS FOR LEARNING

MATHEMATICS

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The Alabama High School Graduation Exam Task Force, composed of middle and high school teachers and local school system supervisors of instruction and curriculum, developed this document.

MATHEMATICS
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STATEMENT OF PURPOSE

This document is designed to assist classroom teachers in preparing students to complete successfully the *Alabama High School Graduation Exam* (AHSGE). Classroom teachers from all areas of Alabama were selected to participate in its preparation. The teaching strategies, activities, and resources contained in this document were not developed to replace the successful methods teachers are already using or to make the teacher's job more complex but rather to assist teachers in specifically addressing the mandated standards and objectives of the *Alabama High School Graduation Exam.*

These suggested activities have been correlated with *Alabama Course of Study: Mathematics,* Bulletin 1997, No. 4, and *Standards and Objectives (Reading Comprehension, Language, Mathematics, and Science) for Alabama High School Graduation Exam,* Bulletin 1997, No. 16. However, due to the volume of skills and eligible content that will be tested, this document is not intended to be an exhaustive coverage of the required skills and content, nor does the successful completion of the activities in this document assure a student's success on the AHSGE.

Possible reading and writing connections are included within this document for each standard and objective of the mathematics subject-area test of the *Alabama High School Graduation Exam.* Since teachers in all content areas share the responsibility for teaching reading comprehension skills, suggestions have been included to assist mathematics teachers with this process. Each suggestion is linked to a specific reading comprehension standard and objective from *Standards and Objectives (Reading Comprehension, Language, Mathematics, and Science) for Alabama High School Graduation Exam,* Bulletin 1997, No. 16. The suggested activities are not intended to be exhaustive. Teachers are encouraged to incorporate additional activities involving reading comprehension skills into their daily assignments.

It should be noted that the task of preparing students for this important exam does not lie solely with the tenth- and eleventh-grade teachers. A major share of the responsibility rests with teachers in Grades 7-9. Elementary school teachers also have a responsibility to teach prerequisite skills. Teachers at all grade levels must work together and assume responsibility for teaching AHSGE competencies. All teachers are encouraged to work together so that continuity of the curriculum may be achieved. Although the resources and activities included in this document are not and should not be the only ones that will be used by teachers, this document should assist the classroom teacher in preparing students to meet the challenges of the *Alabama High School Graduation Exam.*

A. GENERAL INFORMATION

GENERAL INFORMATION ABOUT THE ALABAMA HIGH SCHOOL GRADUATION EXAM (AHSGE) THIRD EDITION

WHAT IS THE ALABAMA GRADUATION EXAMINATION PROGRAM?

The Alabama Graduation Examination Program had its beginning with the April 27, 1977, State Board of Education resolution that mandated that the State Superintendent of Education appoint a committee to develop minimum competencies for high school graduation and to establish plans for measuring those skills. The graduation examination program that grew out of this resolution had as its goal that all Alabama students should have the opportunity to learn the minimum competencies necessary to earn an Alabama high school diploma. There are three editions of the graduation examination. They are as follows:

- *Alabama High School Graduation Examination,* First Edition (AHSGE) – Requirement for any student who was a ninth-grader for the first time on or after the 1981-1982 scholastic year (Class of 1985)
- *High School Basic Skills Exit Exam,* Second Edition (Exit Exam) – Requirement for any student who was a ninth-grader for the first time on or after the 1989-1990 scholastic year (Class of 1993)
- *Alabama High School Graduation Exam,* Third Edition (AHSGE) – Requirement for any student who was a ninth-grader for the first time on or after the 1997-1998 scholastic year (Class of 2001)

The State Department of Education (SDE) has discontinued the administration of the first edition of the graduation examination.

With each new edition, the content of the exam was changed to reflect the increased course requirements for graduation. The third edition is aligned with the course requirements for graduation as adopted by the State Board of Education on April 11, 1996.

WHAT WERE THE STEPS IN DEVELOPING THE AHSGE, THIRD EDITION?

In 1996 the State Board of Education asked the SDE to develop a new graduation examination that would be aligned with new course requirements for graduation. The Test Advisory Committee, composed of educators from all parts of the state, recommended the broad areas to be assessed. In February 1997 the State Board of Education adopted these broad areas.

The Standards and Objectives Committees, composed of teachers representing all parts of the state, using the course of study for each subject area, recommended the standards and objectives for reading comprehension, language, mathematics, science, and social studies to be assessed on the AHSGE.

The proposed standards and objectives were submitted for review to subject-area specialists and educators in all local education agencies, institutions of higher education, and state organizations. Their recommendations were reviewed, and the standards and objectives were refined based on these recommendations. The State Board of Education approved the standards and objectives.

The SDE contracted with a testing company to write the test specifications (eligible content) and test questions for each subject-area test. The Test Specifications Committees, composed of teachers in the state, reviewed, modified, and approved the test specifications. Using these specifications, the items were written by the testing company for each subject-area test. The Content and Bias Review Committees, composed of educators from all parts of the state, reviewed and revised all test items for content and bias. The Content and Bias Review Committees approved all items before they were piloted. The items for the reading, language, mathematics, and science subject-area tests were piloted during the 1997-98 school year. The items for the social studies subject-area test will be piloted during the 1998-99 school year.

WHAT IS THE GENERAL CONTENT OF THE AHSGE?

Reading Comprehension (Reading) Subject-Area Test

The reading subject-area test requires students to read and comprehend articles, poems, editorials, essays, manuals, catalogues, and/or schedules. The reading selections will range from approximately 600-1200 words.

Language Subject-Area Test

The language subject-area test requires students to apply correct grammar and usage, correct capitalization and punctuation, appropriate word choice, correct sentence structure, and appropriate organizational skills for writing/revising.

Mathematics Subject-Area Test

The mathematics subject-area test requires students to perform basic operations on algebraic expressions, to solve equations and inequalities, to apply concepts related to functions, to apply formulas (while being supplied the formula), to apply graphing techniques, to represent problem situations, and to solve problems involving a variety of algebraic and geometric concepts. A page of formulas will be included in each test booklet. Calculators will be provided for each student, although a calculator is not needed in order to solve the problems. The state-provided calculator is a four-function calculator with percent, +/-, and square root keys. Each key performs a single function. Approximately 75% of the test is Algebra I content and 25% of the test is pre-geometry content.

Science Subject-Area Test

The science subject-area test requires students to apply concepts dealing with the nature of science, matter, diversity of life, heredity, cells, interdependence, energy, and force and motion. The Periodic Table will be provided in each test booklet. Approximately 70% of the test is related to biology and 30% of the test is related to physical science.

Social Studies Subject-Area Test

The social studies subject-area test requires students to know content related to the:

- Global influence of the pre-colonial and colonial eras of the Western Hemisphere
- Formation and development of the United States
- Eras of revolution, expansion, and reform prior to the United States Civil War
- United States Civil War era
- Developments of the late 19th to the early 20th centuries
- Causes and effects of World War I
- Great Depression and World War II

(This subject-area test will not be a part of the AHSGE until the spring of 2000, Class of 2002.)

WHAT IS THE PRE-GRADUATION EXAMINATION?

Students will take the pre-graduation examination during the spring of Grade 10. The *Alabama High School Graduation Exam*, Third Edition, is the pre-graduation examination. The pre-graduation examination is intended as a "checkpoint" for students, parents, and teachers so that students' strengths and weaknesses on the content of the AHSGE may be identified. However, should students pass one or more subject-area tests of this examination, they will be given credit toward graduation for passing the subject-area test(s).

WHO TAKES THE PRE-GRADUATION EXAMINATION?

Any student who, at the time of the **spring** administration of the graduation examination, is identified by the school as a tenth-grader **and** reported as such to the central office in attendance records is eligible to take the pre-graduation examination.

WHEN WILL THE PASSING SCORE FOR EACH SUBJECT-AREA TEST OF THE AHSGE BE ESTABLISHED?

The passing score for reading, language, mathematics, and science subject-area tests will be determined after the spring 2000 administration of the AHSGE. The passing score for the social studies subject-area test will be determined after the spring 2001 administration of the AHSGE. It should be noted that tenth-graders taking the pre-graduation examination in spring 1999 will not know if they passed the reading, language, mathematics, and science subject-area tests until after the passing score is established in spring 2000. Therefore, these students will have to take the reading, language, mathematics, and science subject-area tests of the AHSGE in spring 2000. However, if students pass in spring 1999 or spring 2000, they will be given credit toward graduation. Also, tenth-graders taking the social studies subject-area test of the pre-graduation examination in spring 2000 will not know if they passed until after the passing score is established in spring 2001. Therefore, these students will have to take the social studies subject-area test of the AHSGE in spring 2001. However, if students pass in spring 2000 or spring 2001, they will be given credit toward graduation.

WHO MUST TAKE A GRADUATION EXAMINATION?

Since the spring of 1985, all students who receive an Alabama high school diploma from a public school in Alabama must have passed a graduation examination.

Effective July 1, 1995, all students who enroll in an adult diploma program and receive an Alabama high school diploma from a public school in Alabama must have passed a graduation examination.

DO NON-PUBLIC SCHOOL STUDENTS HAVE TO TAKE A GRADUATION EXAMINATION?

No, however, non-public school students may elect to take the graduation examination. If a non-public school student who is enrolled in a private school wants to take the examination, all eligible students of the private school must take the examination. If non-public school students wish to take the examination, they must register with a local public school and pay a fee to the local public school to take the examination. They must take the examination at an assigned public school location.

IF STUDENTS ARE TAKING THE CURRENT HIGH SCHOOL BASIC SKILLS EXIT EXAM (EXIT EXAM), WILL THEY HAVE TO TAKE THE NEW GRADUATION EXAM?

No, students who are currently taking the Exit Exam (Second Edition) will continue to take that edition until it is phased out in several years.

WHO MUST TAKE THE AHSGE, THIRD EDITION?

Any student who was a ninth-grader for the first time in the 1997-98 scholastic year will have to pass the *Alabama High School Graduation Exam* which measures the standards and objectives contained in *Standards and Objectives (Reading Comprehension, Language, Mathematics, and Science) for Alabama High School Graduation Exam*, Bulletin 1997, No. 16.

Any student who was a ninth-grader for the first time on or after the 1998-99 scholastic year will have to pass the *Alabama High School Graduation Exam* which measures the standards and objectives contained in *Standards and Objectives (Reading Comprehension, Language, Mathematics, and Science) for Alabama High School Graduation Exam*, Bulletin 1997, No. 16, and *Standards and Objectives (Social Studies) for Alabama High School Graduation Exam*, Bulletin 1998, No. 13.

Effective July 1, 2000, students enrolling in an adult diploma program will have to pass the *Alabama High School Graduation Exam* which measures the standards and objectives contained in *Standards and Objectives (Reading Comprehension, Language, Mathematics, and Science) for Alabama High School Graduation Exam*, Bulletin 1997, No. 16.

Effective July 1, 2001, students enrolling in an adult diploma program will have to pass the *Alabama High School Graduation Exam* which measures the standards and objectives contained in *Standards and Objectives (Reading Comprehension, Language, Mathematics, and Science) for Alabama High School Graduation Exam*, Bulletin 1997, No. 16, and *Standards and Objectives (Social Studies) for Alabama High School Graduation Exam*, Bulletin 1998, No. 13.

WHEN WILL THE GRADUATION EXAMINATIONS BE ADMINISTERED?

Opportunities

Students following the normal rate of progression in Grades 9-12 are provided four opportunities to take the AHSGE. These four opportunities are defined as the spring administration in the eleventh grade and the fall, midyear, and spring administrations in the twelfth grade. Students will also have an option to take the AHSGE during the summer between the eleventh and twelfth grades at a site to be determined by the local school system.

Testing Dates

The graduation examination will be administered over a five-day period. Tentative dates set aside for administration of the graduation examination are:

- Middle to end of September
- Beginning to middle of December
- Middle to end of March
- Middle to end of July (optional opportunity)

Students will take one subject-area test per day as follows:

- Monday – Reading
- Tuesday – Language
- Wednesday – Mathematics
- Thursday – Science
- Friday – Social Studies

Testing Time

The graduation examination is untimed; however, students may not receive an unreasonable amount of time that would interfere with other school requirements. Each day's testing should be scheduled for approximately three hours, with provisions made for students who need more time.

HOW MANY OPPORTUNITIES WILL A STUDENT HAVE TO TAKE THE TEST AFTER EXITING SCHOOL?

Exited students may continue to take any subject-area test at every regularly scheduled administration for as long as the student wishes to take the subject-area test(s) in order to earn an Alabama high school diploma.

WHO IS AN ELEVENTH-GRADER?

Any student who, at the time of the spring administration of the graduation examination, is identified by the school as an eleventh-grader **and** reported as such to the central office in attendance records is eligible to take the AHSGE.

HOW WILL STUDENTS BE INFORMED ABOUT THE GRADUATION EXAMINATION?

Notification of the Requirement to Pass the Graduation Examination

The graduation examination requirement brochure provides facts pertaining to the graduation examination. All students must receive this brochure when they enter the ninth grade. Parents and students must sign and return the signature portion of the brochure to the high school to indicate that they have received notification of the requirement to pass the graduation examination. Transfer students in the ninth grade or above must receive the same brochure as the students in his/her grade received immediately upon enrollment in the school.

Notification of Test Results

Local Education Agencies (LEAs) are responsible for notifying students and parents of the results of the graduation examination. The SDE will provide LEAs with two copies of the student label which indicates “Pass” or “Fail” for each subject-area test. One label must be placed in the student’s cumulative folder, and the other must be given to the student/parent. If a student fails any subject-area test of the examination, the SDE will provide LEAs with two copies of the individual report. The individual report indicates deficiencies for each subject-area test failed. The LEA must design remediation plans for students utilizing the information provided by the SDE.

WHAT TYPE ITEMS WILL BE ON THE AHSGE, THIRD EDITION?

The test items are multiple-choice with four answer choices. The answer choices for odd-numbered items will be A, B, C, and D. The answer choices for even-numbered items will be E, F, G, and H.

HOW MANY TEST QUESTIONS WILL BE ON EACH SUBJECT-AREA TEST?

The number of items on each subject-area test is as follows:

- Reading – 84 items
- Language – 100 items
- Mathematics – 100 items
- Science – 100 items
- Social Studies – 100 items

WHAT IF A STUDENT COMPLETES ALL COURSE CREDIT REQUIREMENTS BY THE END OF THE TWELFTH GRADE, BUT STILL HAS NOT PASSED THE GRADUATION EXAMINATION?

A student may elect to return to school for remediation for the graduation examination until the age of 21. The school is responsible for providing the remediation. It is a local decision, however, as to how this remediation will take place. A student may continue to take the graduation examination for an unlimited number of times.

HOW DO STUDENTS PREPARE FOR THE GRADUATION EXAMINATION?

Students will need to **master** course content as outlined in the Alabama Courses of Study in English Language Arts, Mathematics, Science, and Social Studies and to retain the fundamental knowledge learned in those courses.

HOW SHOULD EACH SCHOOL SYSTEM DOCUMENT CURRICULAR AND INSTRUCTIONAL VALIDITY FOR THE AHSGE, THIRD EDITION?

School systems must have a comprehensive plan which specifies that the objectives are taught to students in grades as they progress through school.

In order to ensure curricular and instructional validity, the LEAs must include the following in their plans:

- The teaching of the objectives **before** students are tested.

- For any objective with less than 75% of the items correct after the administration of the **pre-graduation** examination, the reteaching of these objectives if the student has successfully completed the course, **or** the scheduling of the student for the course if the student has not successfully completed the course.

- The reteaching of objectives with less than 75% of the items correct on an individual basis after the administration of the **graduation** examination for students who fail any subject-area test.

To document the teaching of objectives before students are tested on them, LEAs should have their plans organized to include the objectives in their course descriptions, scope and sequences, and lesson plans. The LEAs must be able to document that these objectives are included on classroom tests. Documentation of the teaching and testing of the objectives reflects that students have been given the opportunity to learn these objectives as they progress through the grades.

Teachers have the responsibility for assisting students on any objective on which they have less than 75% of the items correct as indicated on the pre-graduation examination individual reports. These objectives should be emphasized and integrated appropriately in the curriculum. Reteaching should be guided by Item Specifications. Students who have not mastered a particular objective should be provided appropriate, alternative instructional strategies.

Following each graduation examination administration, any student who fails a subject-area test(s) **must** be retaught any objective with less than 75% of the items correct. This reteaching must be documented on a form(s) that includes, but may not be limited to, the following:

- The name of the student.
- Each objective in each of the subject areas (reading, language, mathematics, science, and social studies) where the student did not achieve 75% of the items correct.
- Spaces beside each objective where the dates of reteaching and the initials of the person doing the reteaching are recorded.
- Space for naming activities/materials used in reteaching.

In addition to the individual documentation form, samples of the student's work including classroom tests **must** be retained.

For students passing the graduation examination by the end of their twelfth-grade year, documentation must be retained for four years after their graduation. (Example: John Jones has passed the graduation examination, met course credit requirements, and graduated in May 1999. His documentation must be kept on file until 2003.)

For students not passing the graduation examination, documentation must be retained until four years after they successfully complete the graduation examination or until four years following the student's last attempt to pass the graduation examination. (LEAs must also adhere to all other regulations regarding the documentation and retention of records for students of special populations.)

B. SUBJECT-AREA TEST INFORMATION

Alabama High School Graduation Exam (AHSGE)
Mathematics Subject-Area Test Information

What content is included?

The content for the mathematics portion of the AHSGE is included in *Standards and Objectives, (Reading Comprehension, Language, Mathematics, and Science) for Alabama High School Graduation Exam,* Bulletin 1997, No. 16. All test content is included in *Alabama Course of Study: Mathematics,* Bulletin 1997, No. 4.

A brief overview of this content is included in the table below.

CONTENT ON THE
ALABAMA HIGH SCHOOL GRADUATION EXAM
MATHEMATICS SUBJECT-AREA TEST

Standard Number	Content	Number of Objectives	Number of Test Items
I	Perform basic operations on algebraic expressions.	4	16
II	Solve equations and inequalities.	4	16
III	Apply concepts related to functions.	2	8
IV	Apply formulas. (Formulas will be given in each item.)	2	8
V	Apply graphing techniques.	4	14
VI	Represent problem situations (translate).	1	6
VII	Solve problems.	8	32
	TOTAL NUMBER OF TEST ITEMS		100

NOTE: 75% ALGEBRA I AND 25% PRE-GEOMETRY (Concepts and Skills of Geometry, Spatial Sense, and Measurement as found in the 1997 *Alabama Course of Study: Mathematics* Prior to Algebra I)

Where is the content taught?

The content essentially comes from four courses:
- 7th Grade Math
- 8th Grade Math
- Introduction to Algebra (optional)
- Algebra I

Required content, however, is often covered in more than one course (as indicated in the Course of Study). Students not taking Introduction to Algebra, therefore, should still be taught the required content in Algebra I or one of the other courses. Likewise, advanced students skipping Grade 8 Math to take Algebra I early should also cover concepts missed before they take the graduation examination. Teachers and administrators should evaluate their curriculum carefully to make sure that all concepts are covered by all students prior to the administration of the exam.

How do I know if I am teaching the appropriate content for the AHSGE, Third Edition?

All content from the mathematics subject-area test comes from the mathematics Course of Study. If teachers teach all the content identified in the Course of Study for the grades or courses they teach, they should be covering the required content. Careful attention must also be paid to the AHSGE standards and objectives identified in Bulletin 1997, No. 16. (Note: Teachers have a responsibility to teach all content standards from the Course of Study. Even if an objective from the Course of Study is not listed as an AHSGE objective, the teacher still has the responsibility to teach that objective.)

Will students be allowed to use a calculator on the mathematics subject-area test of the AHSGE, Third Edition?

Yes. The Alabama State Department of Education will provide a basic calculator for all students to use during the mathematics subject-area test. Practice time and instruction on using the calculator will also be provided for students during the week prior to the administration of the test. The calculator provided will include the following function keys: $+, -, \div, \%, \sqrt{\ }, +/-$. Each key performs a single function. Students will not be allowed to use their own calculators. All questions on the mathematics subject-area test can be answered without a calculator.

Will students be allowed to use scratch paper?

Yes. Students may write in the test booklets. If a student requests scratch paper, it is the responsibility of the LEA to furnish it. The proctor will collect all scratch paper each day of the test. The building test coordinator will shred the scratch paper each day of the test.

Is the test timed?

No. Students will not have to complete the test within a designated time limit.

Will students be required to memorize a lot of formulas for the mathematics subject-area test of the AHSGE, Third Edition?

No. Though teachers may certainly require the memorization of certain formulas for tests in individual courses, students will not have to recall numerous formulas on this examination. For one standard of the test, formulas are given in the problems. A page of formulas will be included in each test booklet. A sample of the reference page is included in *Item Specifications for the Alabama High School Graduation Exam, Third Edition, Mathematics*, Bulletin 1999, No. 39.

How Can Teachers Most Effectively Use This Mathematics Document?

- Become familiar with the **entire** document. Pay careful attention to standards, objectives, and eligible content.

- Refer to this document when preparing lesson plans and remediating students.

- For each AHSGE standard and objective detailed in this document, read carefully to determine the content standards, prerequisite skills, and related skills from the Course of Study that should be covered in the courses taught. Highlight the Course of Study content standards in each section of the document to determine easily the major responsibilities for that specific section. The mathematics subject-area test does not contain content above the level of Algebra I. Courses above that level are identified with **Expansion/Review Material* in the tables to indicate that the identified content has been taught in an earlier course, but is being reviewed or used as a foundation for teaching new concepts.

- **Remember that eligible content is not exhaustive. Do not restrict teaching to those items only. Read the standards and objectives carefully to identify all content that students are expected to know.**

- Be aware that the prerequisite skills, standards, objectives, and related skills may range from Grade 5 through Grade 12. Responsibilities do not rest just with high school teachers. A major share of the responsibility also belongs to middle (and even elementary) school teachers.

- Use the activities appropriately.
  - Activities from the document may be used as a part of the instructional plan for teaching prerequisite skills and/or examination objectives. Other activities may be used as needed.
  - Adapt the activities to the age, grade level, and/or instructional needs of the students.
  - Be aware that some activities should be used to introduce concepts or allow for discovery of concepts, while others are more specifically designed to cover content.
  - **Be aware that activities for each objective (under each standard) are included, but they do not cover all eligible content items. These activities alone are not designed to provide all the teaching and practice needed to help students master the content of the AHSGE.**
  - Make sure that all activities are followed by specific examples of the types of problems involved in the standard and objective. Students should then be given problems to work on their own. These problems should specifically target the skills required in correctly using the identified content.

Instructional Strategies and Techniques
What Should Teachers Do?

Teachers can enhance students' chances for success by ...

- Teaching all the content specified in *Alabama Course of Study: Mathematics,* Bulletin 1997, No. 4, for each course or grade level.
- Teaching students HOW TO take notes, organize material, study, and take tests (test-taking tactics).
- Having materials such as the state Course of Study, local curriculum guides, the *Compendium Supplement* of the *Stanford Achievement Test Series*, Ninth Edition, supplementary materials that accompany textbooks, and other resources available as plans are developed for instruction and assessment.
- Attending staff development sessions on instructional assistance and methods for using supporting documents (standards, courses of study, etc.).
- Providing guided and independent practice.
- Providing hands-on activities and other opportunities for active learning experiences.
- Providing assessments that are directly linked to instruction.
- Considering the different learning styles of students as plans are made for instruction.
- Using students' prior knowledge to strengthen their understanding.
- Making mathematics relevant.
- Stressing vocabulary.
- Providing activities that reach all modalities: auditory, kinesthetic, visual, tactile.
- Providing intervention strategies.
- Using student self-assessment.
- Providing opportunities for cooperative and group learning.

Suggestions for Preparing and/or Remediating Students for Success on the AHSGE

To prepare students better, school administrators should ...

- Provide the faculty with a list of all students scheduled to take or retake the mathematics subject-area test of the graduation examination.
- Provide more professional development opportunities for teachers.
- Solicit postsecondary and business involvement in after-school and summer tutorial programs.

The role of teachers in preparing and/or remediating students is to ...

- Teach all the content specified in *Alabama Course of Study: Mathematics,* Bulletin 1997, No. 4, for each course or grade level.
- Use previous assessments to profile students' academic strengths and weaknesses. (Grades 8 - 10 Stanford 9 individual reports, Grade 7 writing assessments, and pre-graduation exam individual reports could be used for this purpose.)
- Analyze SAT group reports to evaluate curriculum and instruction.
  - Are there gaps in the program?
  - Is more emphasis needed in some areas?
  - Does the sequence of concepts need to be changed?
- Provide opportunities for students who are not mastering material to use tutorial software.
- Use a computer management system to record student progress.
- Develop practice tests written in the same format as the graduation examination and include appropriate practice items on teacher-made tests throughout the year.
- Create practice problems on each objective to assist with practice and mastery of the specific objectives.
- Use a variety of instructional techniques to teach **all** students.

To make sure students are adequately prepared for the graduation exam, they should ...

- Form peer tutoring groups to assist each other in preparation for the test.
- Use their student report of the pre-graduation examination and/or the graduation examination results to set goals for improvement on their next test opportunity.
- Think about more than one way to solve a problem. (Use one method to solve and another method to check.)
- Use estimation skills.
- Avoid unnecessary absences from school.
- Become calculator and computer literate.
- Always ask for help before test time and complete all homework assignments promptly.
- Take responsibility for their own learning.

Parents can help if they ...

- Make sure their children attend school every day possible.
- Make sure their children are completing homework assignments daily and are going to class prepared.
- Encourage their children to seek additional help when they experience difficulty mastering specific concepts.
- Require students to study and prepare adequately for the test.
- Request information on test content from school representatives.

To provide additional help, communities can ...

- Establish mentoring programs to assist students in preparing for the test.
- Publicize *Alabama High School Graduation Exam* information.

Motivational Ideas

To increase motivation, students should have the opportunity to ...

- Experience the world of mathematics without mastery of pencil-and-paper computation.
- Become actively involved in the learning process.
- Work with others on math problems, projects, or other classroom activities.
- Explore relationships among different math topics and between math and other subject areas.
- Use technology such as calculators and computers.
- Discuss mathematics.
- Seek the applicability of mathematical concepts to common and complex problems through explorations, videos, magazine articles, and open-ended problems.
- Contribute ideas to the classroom.
- Praise themselves as well as others.

The teacher's role in motivation is to ...

- Set high expectations for **all** students.
- Develop lesson plans that include the learning objective, an interesting opening activity, essential vocabulary, extra help with difficult concepts, a brief summary, and a clearly stated assignment.
- Be enthusiastic during instruction.
- Provide practice time for learning new material or learning to use new equipment.
- Provide a classroom environment conducive to learning and one that encourages students to ask questions, take risks, and learn from their mistakes.

- Provide positive reinforcement for good student behavior and/or achievement such as homework passes, incentive points, and improvement points.
- Create interest in mathematics through competitions, projects, field trips, games, guest speakers, and other activities.
- Provide different modes of instruction that emphasize problem solving, applications, and thinking processes. (Using cooperative learning or student pairing; incorporating manipulatives, models, or measuring devices; and integrating calculators or computers on a regular basis should increase the effectiveness of instruction.)
- Avoid giving busy work for homework or during class time.
- Develop good questioning techniques. (Avoid questions that have one-word answers.)
- Provide frequent feedback.
- Be a coach, a mentor, and a facilitator.

School administrators may increase student motivation through …

- Academic pep rallies led by community leaders.
- Recognition and awards programs. (Rewards could include certificates, food, T-shirts, passes to school events, bumper stickers, and similar items.)
- Discussion of personal and schoolwide assessment results with students.
- Staff development activities.
- Curriculum evaluation and revision.

C. ACTIVITIES: MATHEMATICS

STANDARD I: The student will be able to perform basic operations on algebraic expressions.

OBJECTIVE 1: Apply order of operations.

ELIGIBLE CONTENT:

- One, two, or no variables may be used.
- One set of parentheses may be used.
- Determining the absolute value of a term may be required.
- Squaring the quantity in parentheses may be required.
- No more than four terms may be included.
- Adding or subtracting negative integers may be required.
- Decimals to the tenths' place may be used.

NUMBER OF TEST ITEMS: 4

SUBJECT	LOCATION OF OBJECTIVE WITHIN THE COURSE OF STUDY	PAGE
7th Grade Math	37. Demonstrate proficiency in the use of the order of operations.	58
8th Grade Math	3. Demonstrate proficiency in evaluating rational number expressions using the order of operations. 34. Simplify and evaluate linear algebraic expressions.	62 67
Introduction to Algebra	9. Demonstrate proficiency in simplifying rational number expressions using the order of operations.	74
Algebra I	4. Use the order of operations, including exponentiation, to simplify numeric and variable expressions. 20. Perform basic operations on algebraic expressions. 22. Know and use laws of exponents including zero and negative integral exponents.	80 82 82
***Algebra II with Trig.**	2. Perform operations on rational variable expressions. 4. Perform operations involving polynomials including polynomials with complex coefficients.	94 94
***Advanced Mathematics**	1. Use and apply the axioms of equality and the axioms of order.	104

**Expansion/Review Material*

SUBJECT	PREREQUISITE SKILLS OR RELATED SKILLS FOR THIS OBJECTIVE WITHIN THE COURSE OF STUDY	PAGE
5th Grade Math	3. Demonstrate proficiency in the use of basic operations on whole numbers through two-digit multipliers.	42
	4. Divide whole numbers with two-digit divisors.	42
	9. Add, subtract, and multiply decimals.	43
	39. Recognize number sentences that serve as examples of properties of numbers.	47
	42. Develop an understanding of the order of operations.	47
6th Grade Math	6. Demonstrate proficiency in adding, subtracting, and multiplying decimals.	49
	7. Divide decimals.	49
	15. Add and subtract integers.	50
	40. Apply properties of operations to number sentences.	52
	41. Demonstrate an understanding of the addition and subtraction properties of equality.	52
	42. Demonstrate an understanding of exponential notation.	53
	43. Extend the understanding of the order of operations.	53
7th Grade Math	2. Add, subtract, multiply, and divide integers.	55
	5. Perform basic operations on rational numbers.	55
	9. Evaluate powers of whole numbers and roots of perfect squares.	55
	43. Simplify and evaluate linear algebraic expressions.	59
	48. Exhibit understanding of the properties of rational numbers.	59
8th Grade Math	1. Demonstrate proficiency in performing basic operations on rational numbers.	62
	6. Apply the laws of exponents to simplify expressions containing integral exponents.	62
	14. Recognize and use absolute value of real numbers.	63
	38. Demonstrate proficiency in recognizing the commutative, associative, and identity properties.	67
	39. Use the properties of rational numbers.	67
Introduction to Algebra	2. Demonstrate proficiency with operations on integers and rational numbers.	74
	3. Apply properties of real numbers.	74
	4. Recognize, simplify, and use irrational numbers.	74
	12. Apply the laws of exponents to simplify expressions containing natural number exponents.	75

SUBJECT	PREREQUISITE SKILLS OR RELATED SKILLS FOR THIS OBJECTIVE WITHIN THE COURSE OF STUDY (cont.)	PAGE
Introduction to Algebra (cont.)	13. Recognize absolute value as distance from zero on the number line. 33. Evaluate algebraic expressions.	75 77
Algebra I	6. Apply the number properties. 7. Recognize absolute value of a number as its distance from zero on a number line.	80 80
***Algebra II With Trig.**	5. Simplify a number within any subject of the set of complex numbers. 37. Simplify expressions involving rational and irrational exponents.	94 98

**Expansion/Review Material*

TEACHER OVERVIEW

Everyone agrees to follow specific mathematical conventions or a specific order of operations when evaluating expressions with more than one basic operation. This ensures consistency when performing basic operations on algebraic expressions. "Order of operations" refers to the order in which these basic operations within an algebraic expression should be performed. The correct order of operations is as follows:

- Simplify operations within the parentheses or other grouping symbols (working from the inside outward).
- Simplify all exponents (powers and roots).
- Perform all multiplication and division in order from left to right.
- Perform all addition and subtraction in order from left to right.

A popular way to teach the order of operations is to use the acronym "**P E MD AS**."

P	E	M	D	A	S
ARENTHESES	XPONENTS	ULTIPLICATION	IVISION	DDITION	UBTRACTION

Some students also use the statement "Please Excuse My Dear Aunt Sally" to help them remember the correct order of operations.

The following activities will provide a basis whereby this convention can be solidified within the students' mathematical foundation. One or more of these activities may be used with students, depending upon the instructional needs of the class. Each one illustrates the importance of doing things in a designated order.

All activities should be followed by specific examples of the types of problems involved in applying the correct order of operations. Specific examples are included at the end of the activities. Students should then be given problems to work on their own. These problems should specifically target the skills required in correctly using order of operations with algebraic expressions.

ALGEBRA
WAR

ACTIVITY: Algebra War or Highest Card Wins

Purpose: To practice using the correct order of operations

Materials/Equipment:

Use 3x5 index cards to create several decks of cards that contain problems involving order of operations. Each deck should consist of 50 cards with about ten pairs of cards having equal values for a WAR. Several decks may need to be prepared beforehand. Possible examples to be used when preparing the Algebra War cards could include:

$2 + 3 - (5^2 + 3) \div 2$ *(Answer: -9)*

$10 + 3^2 - (4 + 2)^2 \bullet 3$ *(Answer: -89)*

Procedure:

1. Divide the class into groups of three to four students each.
2. Give each group a deck of cards.
3. One player shuffles the deck carefully and then deals the cards one at a time, face-down, so that all players have the same number of cards. Extra cards are placed in the center of the table to be won by the winner of the first play.
4. The players do not look at their cards but leave them face-down in piles.
5. The object of the game is to win as many cards as possible from the other players. The game ends when one player has all of the cards or, if a time limit is set, at the end of the allotted time. The winner is the player who has the most cards at the conclusion of the game.
6. To play the game, each player turns his or her top card face-up and announces the answer to the problem on the card. The player with the highest value "wins" the round and collects all face-up cards and places them at the bottom of his or her pile.

7. If there is a tie for the highest value, the players who tied have a WAR (play-off). They each turn a card face-up from their piles and announce the answer to the problem on their card. The one with the highest value wins the WAR and collects all face-up cards from the regular round and the WAR.
8. The players continue to play rounds as described above until a game winner is declared.
9. Players will sometimes make errors calculating the answer to the problem. Therefore, they may challenge each other when they think that an error has been made. A player who wishes to challenge says, "challenge," and then announces what he or she thinks the correct answer should be. If that player is correct in his or her challenge, the player who first announced the incorrect answer automatically loses the round. If, however, the challenger is incorrect, he or she loses the round. If the challenged player or the challenger is not the winner of the hand, the loser of the challenge pays a penalty of two cards to the winner of the challenge.

Questions:

1. Does everyone in the group follow the same set of rules in simplifying the problems on the cards? *(Answer: Yes. They should.)*
2. What would happen if different players followed different sets of rules in simplifying the expressions? *(Answers to this question may vary; however, one possible answer may be, "Players may create other rules for simplifying expressions that would yield higher solutions, thus allowing them to win each hand of the game continually.")*
3. Would it affect the outcome of the game? *(Answer: Yes. It could.)*
4. Would there be any opportunities to declare WAR? *(Answer: Possibly, but not likely)*

Reading/Writing Connection:

Reading Comprehension Standard II, Objective 3: Determine cause and effect.

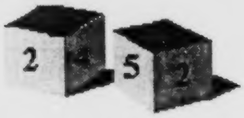
If each player used a different set of rules when playing the game, what effect would this have on the outcome of the game? Discuss the possibilities with the class.

ACTIVITY: Rolling with Order of Operations*

Purpose: To allow students an opportunity to develop strategies for using order of operations to find many answers utilizing a limited number of numbers

Materials/Equipment:

3 number cubes of the same color
(or 2 white number cubes and 1 red number cube)



Procedure:

1. Divide the class into groups of three or four students each.
2. The teacher should roll the three number cubes and record the three numbers that resulted from the roll on the overhead or board.
3. Using the three recorded numbers only once, the groups should write as many arithmetic expressions as possible that generate different answers. *(Example: The number cubes are rolled and show the numbers 2, 4, and 5. One student group arranges the numbers to get* $4^2 - 5$ *and calculates the answer to be 11. Another group, however, may arrange the numbers to get* $4 \bullet 5 + 2$ *and calculate the answer to be 22.)*
4. Call on groups to give one of their solutions.
5. Write the solutions on the overhead or board as they are dictated.
6. Allow the other students an opportunity to check the arithmetic and the order of operations.
7. Continue around the room allowing groups to give their answers.
8. Each correct answer receives one point. If a group makes a mistake, the group that finds the mistake earns the point.
9. Variation: roll two white number cubes and one red number cube. Let the red represent a negative number. This will allow the students to extend their experiences with the order of operations.

Note: *Five number cubes can be used as students become more proficient in applying order of operations.*

*(*Contributed by Dr. Mally Moody, retired, Oxford City Schools)*

Questions:

1. What methods ensured that as many solutions as possible were found?
2. How many solutions were given by more than one group?
3. Did the use of negative numbers make the activity more difficult?

Reading/Writing Connection:

Reading Comprehension Standard II, Objective 2: Draw conclusions.

Ask students to create a sample problem containing all of the following: Exponent, Parentheses, Multiplication, Division, Subtraction, and Addition. Next, ask students to write an explanation describing how to use the order of operations to solve the sample problem. The explanation should contain all the steps included in the order of operations and should be written using complete sentences.

ACTIVITY: A Magical Mathematical Birthday Card

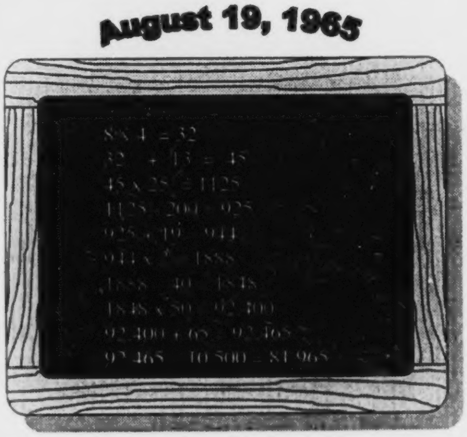
Purpose: To demonstrate the need to follow directions to determine the correct answer

Materials/Equipment:

A blank-verse birthday card that can be purchased at card stores

Procedure:

Write the instructions included in the procedure below on the blank page of the purchased birthday card. Ask students to follow the instructions as they are written.



1. Write the number of the month you were born or enter it into your calculator.
2. Multiply by 4.
3. Add 13.
4. Multiply by 25.
5. Subtract 200.
6. Add the day of the month on which you were born.
7. Multiply by 2.
8. Subtract 40.
9. Multiply by 50.
10. Add the last two digits of your birth year.
11. Subtract 10,500.
12. Now put slashes in your final result so that the digits are in groups of two starting from the right.
    (Example: If your final result is 40,781, place slashes like this: 4/07/81.)

The following two procedural steps may be used as an extension of the activity. The questions could produce several different answers.

13. In many countries of the world, people write dates in the order: day, month, year. That is, instead of writing October 4, 1993, they write 4 October 1993. This is done in some cases in the United States. For example, airlines show dates this way. How would the instructions on the birthday card need to be changed to fit this way of stating dates? (Answers may vary.)
14. There are other countries in which people gives dates in the order: year, month, day (1993 October 4). How would the instructions have changed to fit this system? (Answers may vary.)

Questions:

1. What do you notice? Are you surprised? Why does this work?
2. If you didn't get your date of birth, go through the steps again.
3. Did the other members of the class get their dates of birth?

Reading/Writing Connection:

Reading Comprehension Standard I, Objective 3: Follow directions.
Reading Comprehension Standard II, Objective 3: Determine cause and effect.

If all steps in the first set of instructions were performed correctly, the simplified algebraic expression in step 11 should give the month (m), day (d), and year (y) of birth. Have students check by substituting the appropriate number for m, d, and y and by comparing the two answers. Explain why this algebraic expression puts the numbers represented by m, d, and y in the right places. (Hint: Make use of place-value in the explanation.)

Additional Problems:

1. Evaluate: $(-3 + 7)^2 - 15 \div 5 + |2 - 10|$ *(Answer: 21)*
2. Evaluate: $13^2 + 4(-7 - 3)$ *(Answer: 129)*
3. Evaluate: $-3(-5)^2 + -12 \bullet 6 - 5 \bullet -5$ *(Answer: –122)*
4. $3x \bullet 4y + (2x)^2 - 5(-2y)$ *(Answer: $12xy + 4x^2 + 10y$)*
5. $5x - 4(2x + y) + 6y \div 2$ *(Answer: $-3x - y$)*
6. $x + .3(y - x) - .2y$ *(Answer: $.7x + .1y$)*
7. Expansion Problem
   Evaluate: $[-15 + 6(1 - 2)^2 - 1]^3 \div (-5)$ *(Answer: 200)*

ADDITIONAL RESOURCES

1. *Connected Mathematics®*, G. Lappan, J. Fey, W. Fitzgerald, S. Friel, and E. Phillips; available from Dale Seymour Publications, 1-800-552-2259.
2. *Opening The Gate, Algebra for Everyone*, funded by the Dwight D. Eisenhower Mathematics and Science Education Act, Title II, through the Florida Department of Education.

STANDARD I: **The student will be able to perform basic operations on algebraic expressions.**

OBJECTIVE 2: **Add and subtract polynomials.**

ELIGIBLE CONTENT:
- **Using the distributive property may be required.**
- **Unlike denominators may be used.**

NUMBER OF TEST ITEMS: 4

SUBJECT	LOCATION OF OBJECTIVE WITHIN THE COURSE OF STUDY	PAGE
7th Grade Math	43. Simplify and evaluate linear algebraic expressions.	59
8th Grade Math	34. Simplify and evaluate linear algebraic expressions.	67
Introduction to Algebra	36. Simplify and combine polynomials.	77
Algebra I	4. Use the order of operations, including exponentiation, to simplify numeric and variable expressions. 20. Perform basic operations on algebraic expressions.	80 82
***Algebra II with Trig.**	2. Perform operations on rational variable expressions. 4. Perform operations involving polynomials including polynomials with complex coefficients. 37. Simplify expressions involving rational and irrational exponents.	94 94 98

**Expansion/Review Material*

SUBJECT	PREREQUISITE SKILLS OR RELATED SKILLS FOR THIS OBJECTIVE WITHIN THE COURSE OF STUDY	PAGE
5th Grade Math	3. Demonstrate proficiency in the use of basic operations on whole numbers through two-digit multipliers. 7. Demonstrate proficiency in adding and subtracting fractions with common denominators. 9. Add, subtract, and multiply decimals. 39. Recognize number sentences that serve as examples of properties of numbers. 42. Develop an understanding of the order of operations.	42 42 43 47 47

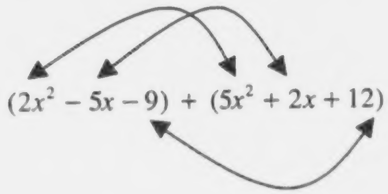
SUBJECT	PREREQUISITE SKILLS OR RELATED SKILLS FOR THIS OBJECTIVE WITHIN THE COURSE OF STUDY (cont.)	PAGE
6th Grade Math	5. Add and subtract fractions that do not have common denominators.	49
	6. Demonstrate proficiency in adding, subtracting, and multiplying decimals.	49
	15. Add and subtract integers.	50
	40. Apply properties of operations to number sentences.	52
	41. Demonstrate an understanding of the addition and subtraction properties of equality.	52
	42. Demonstrate an understanding of exponential notation.	53
	43. Extend the understanding of the order of operations.	53
7th Grade Math	1. Demonstrate proficiency in adding and subtracting fractions without common denominators.	55
	2. Add, subtract, multiply, and divide integers.	55
	5. Perform basic operations on rational numbers.	55
	9. Evaluate powers of whole numbers and roots of perfect squares.	55
	37. Demonstrate proficiency in the use of the order of operations.	58
	48. Exhibit understanding of the properties of rational numbers.	59
8th Grade Math	1. Demonstrate proficiency in performing basic operations on rational numbers.	62
	6. Apply the laws of exponents to simplify expressions containing integral exponents.	62
	14. Recognize and use absolute value of real numbers.	63
	38. Demonstrate proficiency in recognizing the commutative, associative, and identity properties.	67
	39. Use the properties of rational numbers.	67
Introduction to Algebra	2. Demonstrate proficiency with operations on integers and rational numbers.	74
	3. Apply properties of real numbers.	74
	4. Recognize, simplify, and use irrational numbers.	74
	9. Demonstrate proficiency in simplifying rational number expressions using the order of operations.	74
	12. Apply the laws of exponents to simplify expressions containing natural number exponents.	75
	13. Recognize absolute value as distance from zero on the number line.	75
	33. Evaluate algebraic expressions.	77

SUBJECT	PREREQUISITE SKILLS OR RELATED SKILLS FOR THIS OBJECTIVE WITHIN THE COURSE OF STUDY (cont.)	PAGE
Algebra I	6. Apply the number properties. 7. Recognize absolute value of a number as its distance from zero on a number line. 22. Know and use laws of exponents including zero and negative integral exponents.	80 80 82
***Algebra II with Trig.**	5. Simplify a number within any subset of the set of complex numbers.	94

**Expansion/Review Material*

TEACHER OVERVIEW

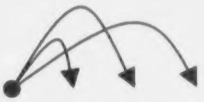
When adding and subtracting polynomials, remind students simply to combine like terms. Some students find this to be difficult. These students tend to struggle with applying the appropriate operation connector between the remaining simplified terms. For example, simplify the following expression:



$$(2x^2 - 5x - 9) + (5x^2 + 2x + 12)$$

Students can combine the like terms to get $7x^2, -3x,$ *and* 3. However, they are reluctant to write the answer as $7x^2 - 3x + 3$. Remind students that the sign of each term is the operation connector between the terms.

Students sometimes have trouble finding the difference between two polynomials. This often occurs because the students forget to distribute the subtraction sign over each term in the second polynomial. For example:



$$(2x^2 - 5x - 9) - (5x^2 + 2x + 12) =$$
$$2x^2 - 5x - 9 - 5x^2 - 2x - 12 \quad =$$
$$-3x^2 - 7x - 21$$

The following activities provide a basis for illustrating the addition and subtraction of polynomials. All activities should be followed by specific examples of problems involved in adding and subtracting polynomials. Examples are included at the end of these activities.

Students should then be given problems to work on their own. Problems should specifically target the skills required in adding and subtracting polynomials.

ACTIVITY: Modeling Mathematics

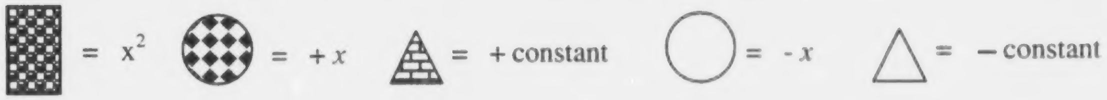
Purpose: To use algebra tiles to demonstrate the procedure for adding and subtracting polynomials and to give students concrete experiences in adding and subtracting polynomials

Materials/Equipment:

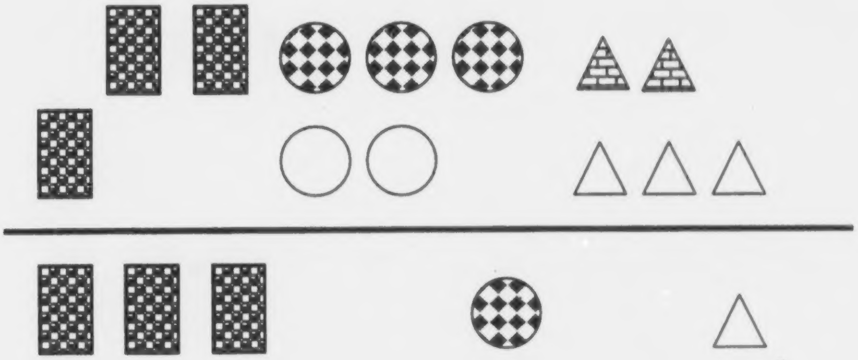
Algebra tiles Overhead algebra tiles

Procedure:

1. Divide the class into groups of three to four students each.
2. Give each group a set of algebra tiles. *(NOTE: If algebra tiles are not available, create sets of tiles as seen below.)*
3. The teacher should inform students of the following:
   - Like terms are represented by tiles that are the same shape and size.
   - Opposite terms have the same shape and size but are different colors.
   - Zero pairs are formed by pairing one tile with its opposite.
   - Zero pairs can be added or removed without changing the value of the polynomial.
   - It may be easier to arrange like terms in columns.
4. Use the overhead algebra tiles to demonstrate the following problem:
   (NOTE: The following example is illustrated with a set of computer-designed algebra tiles.)



$$(2x^2 + 3x + 2) + (x^2 - 2x - 3)$$



$$3x^2 + x - 1$$

5. Ask each group to model the following problems using the technique described in Step 4 on the previous page.

a. $(2x^2-7x+6)+(-3x^2+7x)$	*(Answer:* $-x^2+6$*)*
b. $(-2x^2+3x)+(-7x-2)$	*(Answer:* $-2x^2-4x-2$*)*
c. $(3x^2-5x-2)-(x^2-x+1)$	*(Answer:* $2x^2-4x-3$*)*
d. $(2x^2+3x-4)-(3x^2-4x+1)$	*(Answer:* $-x^2+7x-5$*)*

Questions:

1. Was a pattern noticeable when it was necessary to add zero pairs in order to simplify the expression?
2. What property of equality is described when using zero pairs?

Reading/Writing Connection:

Reading Comprehension Standard II, Objective 2: Draw conclusions.

Have students write a paragraph explaining why a polynomial doesn't change when a zero pair is added to or removed from the polynomial.

ACTIVITY: Musical Polynomials

Purpose: To help students determine the degree of a polynomial after simplifying the polynomial *(NOTE: The music is only a motivating factorof the activity.)*

Materials/Equipment:

Music CD CD Player

Procedure:

1. The teacher starts the music.
2. The teacher asks a student to give an example of a monomial. *(Example: The student says, " 5x.")*
3. The teacher writes "5x" on the board or overhead.
4. The teacher asks another student to give an example of a monomial (either negative or positive) that is not a like term to the first example. *(Example: The student says "* $4x^2$*.")*
5. The teacher writes "+ $4x^2$" beside the "5x" on the board or overhead to yield the binomial $5x+4x^2$.

6. The teacher asks another student to give an example of a monomial (either negative or positive) that is not a like term to either of the first two examples.
   (Example: The student says "$-6x^3$.")
7. The teacher writes "$-6x^3$" beside "$5x + 4x^2$" on the board or overhead to yield the trinomial $5x + 4x^2 - 6x^3$.
8. The teacher asks another student to give an example of a monomial (either negative or positive) that is a like term to one of the first three monomials.
   (Example: The student says "$-7x^2$.")
9. The teacher writes "$-7x^2$" beside "$5x + 4x^2 - 6x^3$" on the board or overhead to yield the polynomial $5x + 4x^2 - 6x^3 - 7x^2$.
10. The teacher continues this process until stopping the music.
11. When the music is stopped, the teacher asks a student to simplify the polynomial expression and to determine the degree of the simplified polynomial. *(The polynomial created above is $-6x^3 - 3x^2 + 5x$ when simplified, with a degree of 3.)*
12. The teacher starts the music again and repeats the process as many times as needed.

Questions:

1. What guarantees that the monomial will affect the size of the polynomial? *(Answer: It will affect the size if the monomial is not a like term to any of the other terms.)*
2. What guarantees that the monomial will affect the degree of the polynomial? *(Answer: It will affect the degree if it has a degree that is higher than that of any of the other terms.)*
3. What determines the degree of a polynomial? *(Answer: The degree is the degree of the term in the polynomial having the highest degree.)*

Reading/Writing Connection:

Reading Comprehension Standard I, Objective 2: Determine sequence of events.

Ask students to explain how to subtract one polynomial from another polynomial and to identify the proper procedure. Is there more than one way to simplify such an expression? Have students write a paragraph giving a sequential order of steps that would assist another student in simplifying the difference of two polynomials.

Additional Problems:

1. Find the difference: $(-6r^2+5rs-7s^2) - 4(-5r^2-11rs+3s^2)$
   (Answer: $14r^2 + 49rs - 19s^2$)
2. Find the sum: $\left(7 - 8x + 3x^2\right) + \left(4 - 5x - 3x^2\right)$ *(Answer : $-13x + 11$)*
3. Simplify: $\dfrac{3a+5}{6} + \dfrac{7(a+1)}{4}$ $\left(\textit{Answer}: \dfrac{27a + 31}{12}\right)$

ADDITIONAL RESOURCES

1. www.forum.swarthmore.edu – Use this home page to search for other activities involving addition and subtraction of polynomials.
2. www.forum.swarthmore.edu/mathmagic
3. www.cs.uidaho.edu/~casey931/mega-math/index – This is a listing of mathematical topics with activities included.
4. www.mste.uiuc.edu:591/mathed/completelist.html
5. www.math.upenn.edu/MathSources.html
6. *Connected Mathematics®*, G. Lappan, J. Fey, W. Fitzgerald, S. Friel, and E. Phillips; available from Dale Seymour Publications, 1-800-552-2259.

STANDARD I: **The student will be able to perform basic operations on algebraic expressions.**

OBJECTIVE 3: **Multiply polynomials.**

ELIGIBLE CONTENT:
- **Multiplying two quantities in parentheses may be required.**
- **Squaring a quantity in parentheses may be required.**
- **Adding or subtracting may be required.**
- **Raising a quantity to a power may be required.**
- **Fractions may be used.**
- **Adding exponents may be required.**

NUMBER OF TEST ITEMS: 4

SUBJECT	LOCATION OF OBJECTIVE WITHIN THE COURSE OF STUDY	PAGE
7th Grade Math	43. Simplify and evaluate linear algebraic expressions.	59
8th Grade Math	34. Simplify and evaluate linear algebraic expressions.	67
Introduction to Algebra	36. Simplify and combine polynomials.	77
Algebra I	4. Use order of operations, including exponentiation, to simplify numeric and variable expressions. 20. Perform basic operations on algebraic expressions. 22. Know and use laws of exponents including zero and negative integral exponents.	80 82 82
***Algebra II with Trig.**	2. Perform operations on rational variable expressions. 4. Perform operations involving polynomials including polynomials with complex coefficients. 37. Simplify expressions involving rational and irrational exponents.	94 94 98

**Expansion/Review Material*

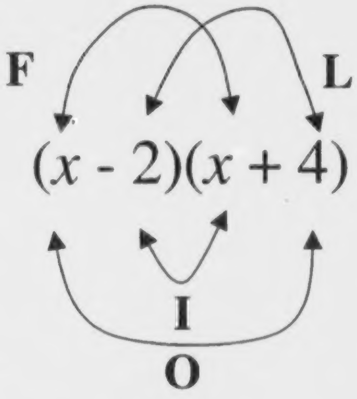
SUBJECT	PREREQUISITE SKILLS OR RELATED SKILLS FOR THIS OBJECTIVE WITHIN THE COURSE OF STUDY	PAGE
5th Grade Math	3. Demonstrate proficiency in the use of basic operations on whole numbers through two-digit multipliers.	42
	8. Multiply and divide fractions.	43
	9. Add, subtract, and multiply decimals.	43
	39. Recognize number sentences that serve as examples of properties of numbers.	47
	42. Develop an understanding of the order of operations.	47
6th Grade Math	6. Demonstrate proficiency in adding, subtracting, and multiplying decimals.	49
	15. Add and subtract integers.	50
	40. Apply properties of operations to number sentences.	52
	41. Demonstrate an understanding of the addition and subtraction properties of equality.	52
	42. Demonstrate an understanding of exponential notation.	53
	43. Extend the understanding of the order of operations.	53
7th Grade Math	2. Add, subtract, multiply, and divide integers.	55
	5. Perform basic operations on rational numbers.	55
	9. Evaluate powers of whole numbers and roots of perfect squares.	55
	37. Demonstrate proficiency in the use of the order of operations.	58
	48. Exhibit understanding of the properties of rational numbers.	59
8th Grade Math	1. Demonstrate proficiency in performing basic operations on rational numbers.	62
	6. Apply the laws of exponents to simplify expressions containing integral exponents.	62
	14. Recognize and use absolute value of real numbers.	63
	38. Demonstrate proficiency in recognizing the commutative, associative, and identity properties.	67
	39. Use the properties of rational numbers.	67
Introduction to Algebra	2. Demonstrate proficiency with operations on integers and rational numbers.	74
	3. Apply properties of real numbers.	74
	4. Recognize, simplify, and use irrational numbers.	74
	9. Demonstrate proficiency in simplifying rational number expressions using the order of operations.	74

SUBJECT	PREREQUISITE SKILLS OR RELATED SKILLS FOR THIS OBJECTIVE WITHIN THE COURSE OF STUDY (cont.)	PAGE
Introduction to Algebra (cont.)	12. Apply the laws of exponents to simplify expressions containing natural number exponents. 13. Recognize absolute value as distance from zero on the number line. 33. Evaluate algebraic expressions.	75 75 77
Algebra I	6. Apply the number properties. 7. Recognize absolute value of a number as its distance from zero on a number line.	80 80
***Algebra II with Trig.**	5. Simplify a number within any subset of the set of complex numbers.	94

**Expansion/Review Material*

TEACHER OVERVIEW

The **FOIL** method is a familiar tool often used when teaching the multiplication of polynomials. This method ensures that all factors in the first binomial are multiplied by each factor in the second binomial. For example,



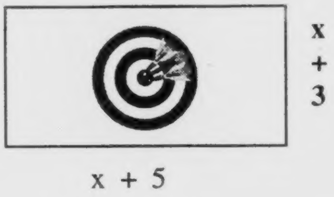
The letters in the acronym represent the following:

F = the product of the first terms of each of the binomials
O = the product of the outer terms of each of the binomials
I = the product of the inner terms of each of the binomials
L = the product of the last terms of each of the binomials

This method yields the answer $x^2 + 4x - 2x - 8 = x^2 + 2x - 8$.

The activities that follow will provide a basis whereby the multiplication of polynomials can be illustrated. All activities should be followed by specific examples of the types of problems involved in multiplying polynomials. (Examples are included at the end of this section.) Students should then be given problems to work on their own. These problems should specifically target the skills required in multiplying polynomials.

ACTIVITY: The Rectangle Game



Purpose: To use algebra tiles to give students concrete experience in multiplying polynomials

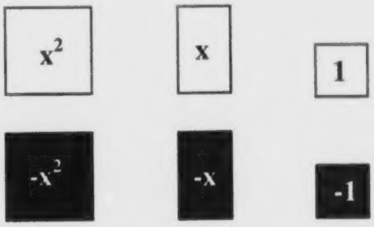
Materials/Equipment:

Algebra tiles
Math tiles display board
Overhead algebra tiles
Product mat

Procedure:

1. Divide the class into groups of three to four students each.
2. Give each group a random number of algebra tiles.
3. Proceed to give the tiles names that are associated with their area. The correlation will be geometrically displayed on a poster board.

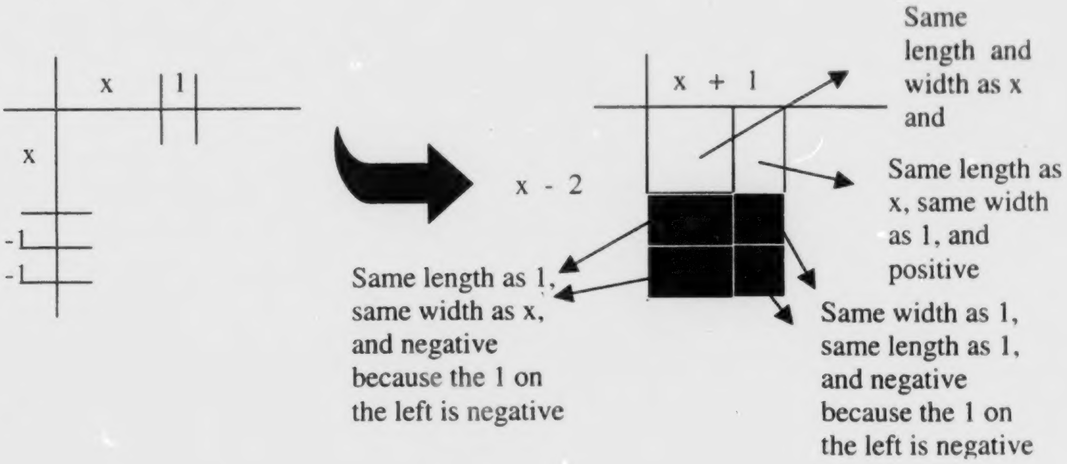
For example:



4. Once the students know the names for the tiles, proceed with an introduction to the multiplication of polynomials.

Example: $(x + 1)(x - 2)$

5. Students must be able to visualize the process of putting the factors to be multiplied on the outer vertical and horizontal spaces provided with the product mat. They should create the rectangle in the innermost space.



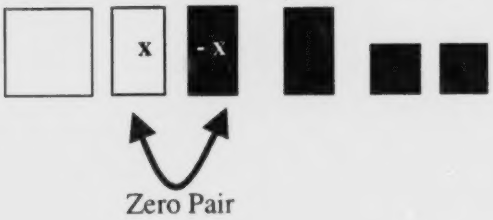
Same length and width as x and

Same length as x, same width as 1, and positive

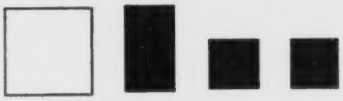
Same length as 1, same width as x, and negative because the 1 on the left is negative

Same width as 1, same length as 1, and negative because the 1 on the left is negative

6. Stress that the length and width are determined by the factors on the outer horizontal and vertical spaces.
7. Once the students have created the innermost rectangle, list the particular tiles that were used.



8. Remind the students that zero pairs are formed by pairing one tile with its opposite. In the example above, there is only one "zero pair" involving the "x" terms.
9. Zero pairs can be added or removed without changing the value of the polynomial. Therefore, after removing the one "zero pair," the following algebra tiles are left:



10. Thus, the final answer is $x^2 - x - 2$.

11. Show the actual problem that students worked on the board, making sure they understand the procedure for doing this.

$$(x + 1)(x - 2) =$$
$$x^2 + x - 2x - 2 =$$
$$x^2 - x - 2$$

12. Tell each group to model the following problems:

a. $(x + 6)(x + 7)$ *(Answer:* $x^2 + 13x + 42$*)*
b. $(x + 3)(x - 2)$ *(Answer:* $x^2 + x - 6$*)*
c. $(x - 4)(x + 1)$ *(Answer:* $x^2 - 3x - 4$*)*

Question:

What was noticeable about the length and width of each rectangle?

Reading/Writing Connection:

Reading Comprehension Standard II, Objective 2: Draw conclusions.

Have students write an explanation of how the rectangle manipulative illustrates the multiplication of polynomials.

Additional Problems:

1. Find the product: $(x + 2)(x + 3)$ *(Answer:* $x^2 + 5x + 6$*)*
2. Find the product: $(2x - 5)(x + 6)$ *(Answer:* $2x^2 + 7x - 30$*)*
3. Find the product: $(x - 5)(x - 8)$ *(Answer:* $x^2 - 13x + 40$*)*
4. Simplify: $\frac{(x-3)^2}{2} + \frac{x(x+2)}{4}$ $\left[\text{Answer: } \frac{3x^2 - 10x + 18}{4}\right]$

ADDITIONAL RESOURCES

1. www.forum.swarthmore.edu – Use this home page to search for other activities involving multiplication of polynomials.
2. www.forum.swarthmore.edu/mathmagic
3. www.cs.uidaho.edu/~casey931/mega-math/index – This is a listing of mathematical topics with activities included.
4. www.mste.uiuc.edu:591/mathed/completelist.html
5. www.math.upenn.edu/MathSources.html
6. *Connected Mathematics*®, G. Lappan, J. Fey, W. Fitzgerald, S. Friel, and E. Phillips; available from Dale Seymour Publications, 1-800-552-2259.

STANDARD I: **The student will be able to perform basic operations on algebraic expressions.**

OBJECTIVE 4: **Factor polynomials.**

ELIGIBLE CONTENT:

- **The following factoring may be required:**
  - **difference of two squares**
  - **greatest common monomial**
  - **trinomial**
  - **common binomial**
- **Options will be factored completely.**

NUMBER OF TEST ITEMS: 4

SUBJECT	LOCATION OF OBJECTIVE WITHIN THE COURSE OF STUDY	PAGE
7th Grade Math	8. Find least common multiples and greatest common factors using prime factorization.	55
8th Grade Math	5. Demonstrate proficiency in determining least common multiples and greatest common factors.	62
Introduction to Algebra	10. Demonstrate proficiency in the application of number theory concepts. 37. Use the distributive axiom to factor polynomials.	75 77
Algebra I	25. Factor algebraic expressions.	82
***Algebra II with Trig.**	4. Perform operations involving polynomials including polynomials with complex coefficients. 36. Perform operations on functions.	94 98

**Expansion/Review Material*

SUBJECT	PREREQUISITE SKILLS OR RELATED SKILLS FOR THIS OBJECTIVE WITHIN THE COURSE OF STUDY	PAGE
5th Grade Math	15. Develop an understanding of number theory concepts.	43
6th Grade Math	11. Use the least common multiple or the greatest common factor of two numbers in operations on fractions.	49
7th Grade Math	43. Simplify and evaluate linear algebraic expressions. 48. Exhibit understanding of the properties of rational numbers.	59 59

SUBJECT	PREREQUISITE SKILLS OR RELATED SKILLS FOR THIS OBJECTIVE WITHIN THE COURSE OF STUDY (cont.)	PAGE
8th Grade Math	34. Simplify and evaluate linear algebraic expressions.	67
	39. Use the properties of rational numbers.	67
Introduction to Algebra	3. Apply properties of real numbers.	74
	36. Simplify and combine polynomials.	77
Algebra I	6. Apply the number properties.	80
*Algebra II with Trig.	27. Solve quadratic equations by using a variety of methods.	97
	59. Solve problems using a variety of methods.	100

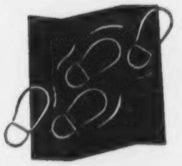
**Expansion/Review Material*

TEACHER OVERVIEW

Factoring monomial expressions can be introduced to middle school students using Venn diagrams. The activities presented in this standard provide a concrete method for finding the prime factors of numbers and for computing the greatest common factor (GCF) of two or three numbers or monomial expressions. An activity that further explores the use of factoring for addition and subtraction of both numeric and algebraic fractions is included in this section. The activities can be extended into the Algebra 1 course when teaching students to factor polynomial expressions. Utilizing Venn diagrams to determine the GCF of groups of numbers or of polynomial expressions allows students to build on previous experiences from their middle school classes. The Box Method provides an alternative paper-and-pencil method for factoring when students do not have access to algebra tiles.

Vocabulary: greatest common factor (GCF), greatest common monomial, monomial, binomial, trinomial, polynomial, factors, terms, Venn diagrams

ACTIVITY: Finding GCF Using Venn Diagrams



What do these two sets of prints have in common?

Purpose: To use set theory to determine the greatest common factor of two or more numbers

Materials/Equipment:

Walt Disney's *Three Little Pigs* (a Little Golden Book) – ISBN 0-307-01028-7
The True Story of the Three Little Pigs by A. Wolf as told to Jon Scieszka – ISBN 0140544518
Jack and the Beanstalk and The Beanstalk Incident (a reversible book) – ISBN 0806513136
Color tiles or squares of four different colors of construction paper
Venn diagram sheets
Overhead Venn diagram master
Overhead color tiles

Procedure:

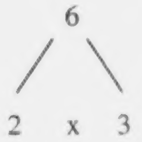
1. Make an overhead Venn diagram master using two circles. Student mats could also be produced.
2. Read one of the following combinations of children's books to introduce the students to using Venn diagrams: (Reading Comprehension Standard I, Objective 1)
   The Three Little Pigs and *The True Story of the Three Little Pigs;*
   Jack and the Beanstalk and The Beanstalk Incident
3. Instruct students to listen closely to each story and to note the details in the two stories.
4. Guide students in using a two-circle Venn diagram to indicate the similarities and the differences in the two stories. The intersection contains similarities, and the differences are listed in each respective circle (outside the intersection).
5. Instruct students to write their own version of the children's stories and make a three-circle Venn diagram based on the two published stories and their own version of each story.
6. Proceed from this activity to the study of factoring polynomials.

EXAMPLE:

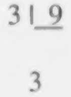
Find the greatest common monomial of $6x^2$ and $9x^3$.

7. Review prime and composite numbers.
8. Designate values for the four colors of tiles or construction paper squares. Example: red–2; green–3; yellow–5; blue–7.
9. Tell students to find the prime factorization of 6 and 9 using either a factor tree or upside-down division. The prime factorizations are as follows: $6 = 2 \times 3$ and $9 = 3 \times 3$.

Factor tree



Upside-down division



10. Instruct students to show the prime factorizations using the appropriate color tiles.
11. Model how to place these color tiles into the Venn diagram to illustrate the products of each number. Label each circle to clarify which number is being represented by each circle. When modeling this for students, both tiles representing 3 in the intersection could be placed on top of each other; however, emphasize that no factors are being discarded. It is necessary to show each common factor only once in the Venn diagram. (See Figure 1.)

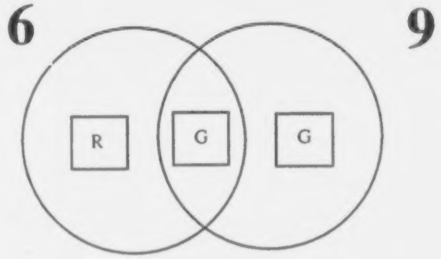


Figure 1

12. Tell students to determine what prime factors both numbers share. The shared prime factor(s) will be in the intersection of the two circles. If there is more than one number in the intersection, they must be multiplied together to find the GCF. If there is no value given in the intersection, the GCF of the numbers is 1 (not zero).
13. An extension to this portion of the activity is to show that the least common multiple (LCM) is represented by the union of the two circles. Students can find the LCM by multiplying everything found in all circles. *(NOTE: Finding the LCM is not a part of this objective.)*

$$\begin{aligned} \text{LCM} &= R \bullet G^2 \\ &= 2 \bullet 3^2 \\ &= 2 \bullet 9 \\ &= 18 \end{aligned}$$

14. Review algebra tile representations.
15. Tell students to represent x^2 and x^3 in their expanded form [(x)(x) and (x)(x)(x)]. Ask students to place the appropriate algebra tile representations in the Venn diagram.
16. Model how to place these algebra tiles into the Venn diagram to illustrate the products of each term. Be sure to label each circle to clarify which term is being represented by each circle. When modeling this for students, both tiles representing x in the intersection could be placed on top of each other; however, emphasize that no factors are being discarded. (See Figure 2.)

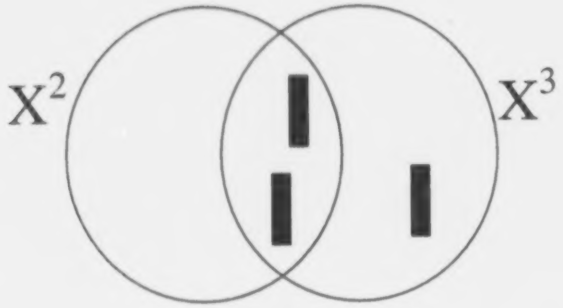


Figure 2

17. Show students how to find the greatest common monomial for the example problem by combining the two individual Venn diagrams into one diagram. (See Figure 3.)

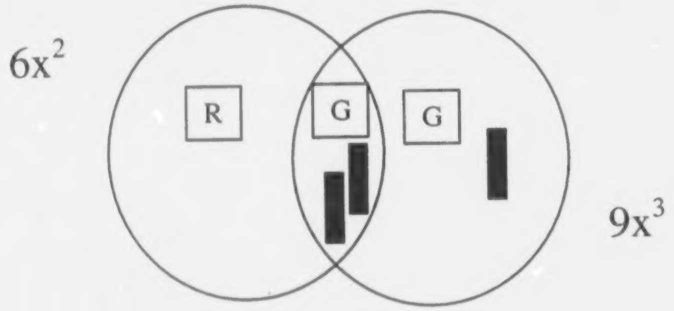


Figure 3

18. Tell students to determine what prime factors both numbers share. The shared prime factor(s) will be in the intersection of the two circles. If there is more than one number in the intersection, they must be multiplied together to find the GCF. If there is no value given in the intersection, the GCF of the numbers is 1 (not zero).
19. State that the greatest common monomial term of $6x^2$ and $9x^3$ is $3x^2$.
20. Encourage students to follow these procedures with every problem assigned until they become proficient at determining the GCF of various number pairs or triples.

***Questions*:**

1. How does the study of greatest common factor and least common multiple help in the study of operations on fractions?
2. Why would it be necessary to show each common factor only once in the intersection?
3. How can color tiles be used to demonstrate addition and subtraction of fractions?
4. Which part of the three-circle Venn diagram would represent the intersection?
5. How can the LCM of three numbers be determined?

Reading/Writing Connection:

Reading Comprehension Standard I, Objective 1: Identify supporting details.
Reading Comprehension Standard I, Objective 2: Determine sequence of events.
Reading Comprehension Standard IV, Objective 3: Discern organizational patterns.

Have students write a paragraph explaining in detail how to add two fractions without like denominators by using the method utilized in this activity.

ACTIVITY: Factoring Polynomial Expressions Using Algebra Tiles

Purpose: To provide a concrete representation for finding factors of a polynomial expression

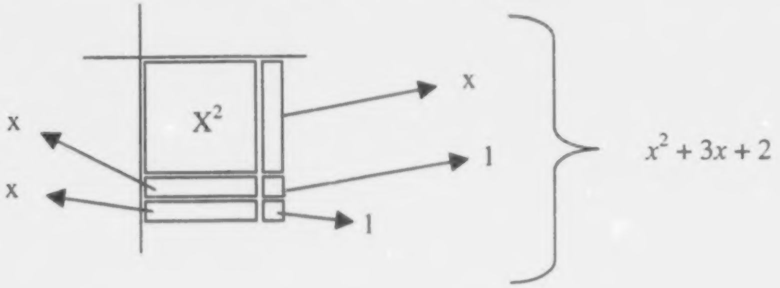
Materials/Equipment:

Algebra tiles
Overhead factoring mats
Overhead algebra tiles
Factoring mats

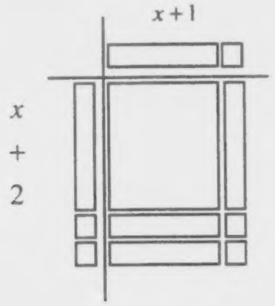
(See Standard II, Objective 2 for algebra tile masters.)

Procedure:

1. Review what each algebra tile represents.
2. Introduce students to factoring a polynomial expression. Use the factoring mats to accomplish this objective.
3. Ask students to place the representative tiles for $x^2 + 3x + 2$ on their work area. Ask them to use all pieces to make a square or rectangle. (Some students may need to be instructed that the large square tile goes into the upper left corner of the factor mat. Otherwise, students may begin with the rectangular pieces in that position.)



4. Tell students to place above and to the left of the square or rectangle the pieces that are represented by the sides.



5. The factorization for this problem is (x + 1) (x + 2). Make sure students know that the order of the binomial factors is insignificant since multiplication is commutative.
6. Students should practice other problems until they become proficient in finding factors of polynomials in this manner. Paper and pencil methods can be utilized after students have a conceptual understanding of factoring trinomials.
7. Other types of problems, such as $x^2(x + 3) - 2(x + 3)$, could also be explored. Students will need experience in recognizing (x + 3) as the common factor and in writing the factors in the form of $(x + 3)(x^2 - 2)$.

Additional Problems:

Factor:

1. $x^2 - 9$	*[Answer: (x − 3) (x + 3)]*
2. $3x^2 + 6xy$	*[Answer: 3x(x + 2y)]*
3. $x(x + 2) - 4(x + 2)$	*[Answer: (x + 2)(x − 4)]*
4. $x^2 - 2x - 15$	*[Answer: (x − 5) (x + 3)]*

Reading/Writing Connection:

Reading Comprehension Standard I, Objective 2: Determine sequence of events.
Reading Comprehension Standard II, Objective 1: Draw conclusions.

Write a definition for area and explain how the area of a rectangular object is computed. Explain how factoring polynomials is related to the concept of finding area.

ACTIVITY: The Box Method

Purpose: To provide a process for factoring that would replace guessing and checking for the correct factors

***Procedure*:**

Example: Factor $6x^2 - 11x + 4$

1. When terms are in descending order of power for the variable (x in this problem), place the first term in the upper left box and the last term in the lower right box.
2. Multiply the first and last terms together. ($6x^2 \bullet 4 = 24x^2$)
3. Find all pairs of factors of the product in Step 2. One pair of these factors will combine to equal the middle term. Place those two factors in the remaining two boxes.
4. Factor out the common monomial factor in each row and column as shown.

(NOTE: If the left box in either row or the top box in either column is negative, the common factor will be negative.)

Pictorial representations of each step of the Box Method for factoring polynomials are shown below.

STEP 1

$6x^2$	
	4

STEP 2

$6x^2$	
	4

$6x^2 \bullet 4 = 24x^2$

STEP 3

$6x^2$	$-8x$
$-3x$	4

$24x^2 = (-8x)(-3x)$
($-8x$ and $-3x$ are chosen because their sum is $-11x$)

STEP 4

	$3x$	-4
$2x$	$6x^2$	$-8x$
-1	$-3x$	4

The horizontal terms and the vertical terms are the factors of the equation.
[Answer: $(3x - 4)(2x - 1)$]

ADDITIONAL RESOURCES

1. *Basic Algebra,* Jerome D. Kaplan, Ed.D, Educational Design, Inc., 1996.
2. *Key to Algebra – Polynomials,* Julie King and Peter Rasmussen, Key Curriculum Press, ISBN 1-55953-004-9.
3. Algebra Mods, Brad and Bonny Davidson, from Educational Teaching Aids (ETA®), a division of A. Daigger and Co. Inc., Vernon Hills, IL 60061.

STANDARD II: The student will be able to solve equations and inequalities.

OBJECTIVE I: Solve multi-step equations of first degree.

ELIGIBLE CONTENT:
- One set of parentheses may be used.
- Finding the sum or difference of terms containing the same variable may be required.
- Adding or subtracting a variable to or from both sides of the equation may be required.
- The solution to the equation may be a fraction.
- Coefficients may be simple fractions.

NUMBER OF TEST ITEMS: 4

SUBJECT	LOCATION OF OBJECTIVE WITHIN THE COURSE OF STUDY	PAGE
7th Grade Math	46. Solve linear equations of the type ax + b = c.	59
8th Grade Math	36. Solve linear equations and inequalities.	67
Introduction to Algebra	35. Solve simple linear equations.	77
Algebra I	26. Solve linear equations.	83
*Geometry	31. Solve an equation involving radicals. 33. Solve a problem using ratio or proportion.	90 90
*Algebra II with Trig.	29. Solve word problems that involve linear or quadratic equations.	97

**Expansion/Review Material*

SUBJECT	PREREQUISITE SKILLS OR RELATED SKILLS FOR THIS OBJECTIVE WITHIN THE COURSE OF STUDY	PAGE
5th Grade Math	42. Develop an understanding of the order of operations.	47
6th Grade Math	41. Demonstrate an understanding of the addition and subtraction properties of equality.	52
7th Grade Math	42. Use vocabulary associated with algebra. 45. Solve equations and inequalities by substituting values from a given set (domain).	59 59
8th Grade Math	34. Simplify and evaluate linear algebraic expressions. 37. Use linear equations and inequalities to solve problems.	67 67
***Mathematics in Society**	18. Calculate appreciation or depreciation and assess the impact on the value of items.	112

**Expansion/Review Material*

TEACHER OVERVIEW

Successful development of mathematical skills requires students to find solutions of various problems. Mastery of solving linear equations is essential for solving advanced problems and equations. The most common method used to solve linear equations is the balance scale strategy. The following activity will provide students practice in isolating a variable. The methods to be used are: 1) the inverse operation method, which utilizes the skills learned in the addition, subtraction, and multiplication of real numbers unit; and 2) the "undo" method, which utilizes mental computation to keep the balance scale level. What is done to one side of the scale (the equation) must also be done to the other side.

ACTIVITY: Balance the Scale

Purpose: To serve as an introductory activity for solving linear equations

Materials/Equipment:

Algebra tiles (Multi-colored construction paper can be substituted for the tiles.)
Equation mat (Plain white typing paper with the balance symbol drawn on it can be used.)

Procedure:

Model and solve the equation 2x + 4 = -6.

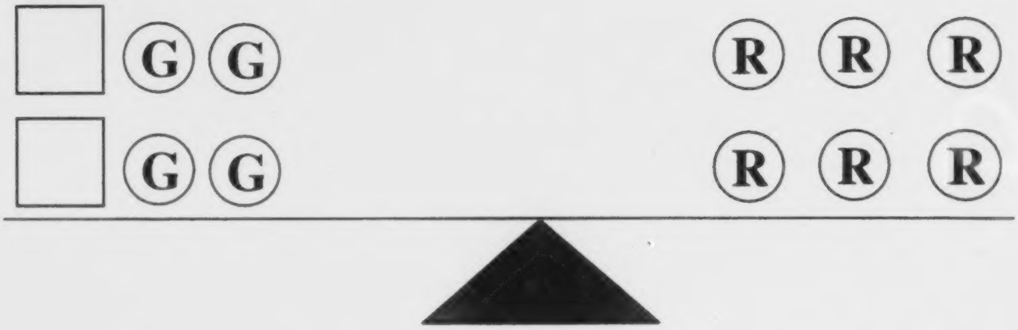
1. Place 2 squares (representing x) and 4 green circles (positive units) on the left side of the mat.
2. Place 6 red circles (negative units) on the right side of the mat.
3. Ask: "How many circles should be added to the left side to make the numerals equal to zero?" *(Answer: 4)*
4. Ask: "Should they be green or red circles?" (*Red*) "Why?" *(Answer: To form zero pairs with the 4 green circles that are positive)*
5. Add 4 red circles to the left side.
6. Ask: "What must I do now to keep the equation balanced?" *(Answer: Add 4 red circles to the right side.)*
7. Add 4 red circles to the right side.
8. Ask: "If the circles on the left side are grouped, what will happen?" *(Answer: There will be 4 red circles and 4 green circles, which will add to equal zero.)*
9. Group the circles on the left side.
10. 10. Ask: "What will happen if the circles on the left side are removed?" *(Answer: Only the 2 squares will be left.)*
11. Remove the circles on the left side.
12. Ask: "What remains on the left side of the mat?" *(Answer: Two squares)*
13. Ask: "What remains on the right side of the mat?" *(Answer: 10 red circles)*
14. Ask: "What will happen if the remaining circles are separated into 2 equal groups to match the 2 squares?" *(Answer: Each group of circles would be paired with 5 circles.)*
15. Ask: "What is matched with each x (or each square)?" *(Answer: 5 red circles)*
16. Ask: "The 5 red circles represent what integer?" *(Answer: -5)*

Solution: x = -5

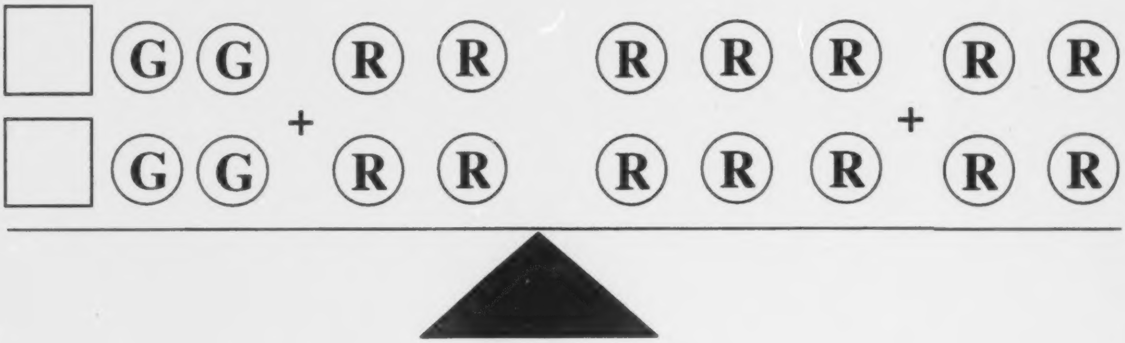
Illustration: ***Balance Scale***

□ = x   Ⓖ = + constant   Ⓡ = – constant

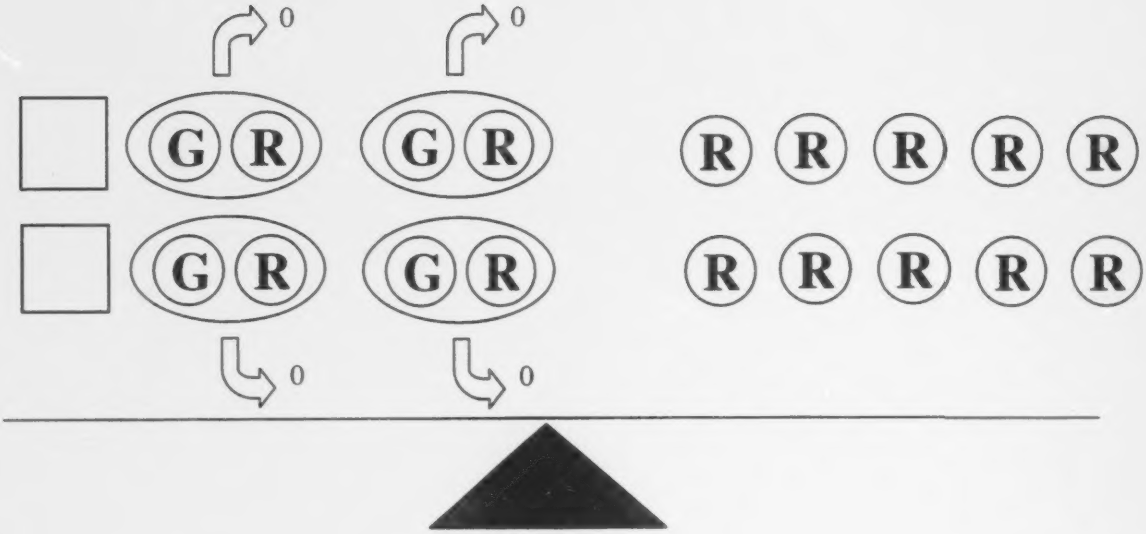
Steps 1-2:


G G
G G
R R R
R R R

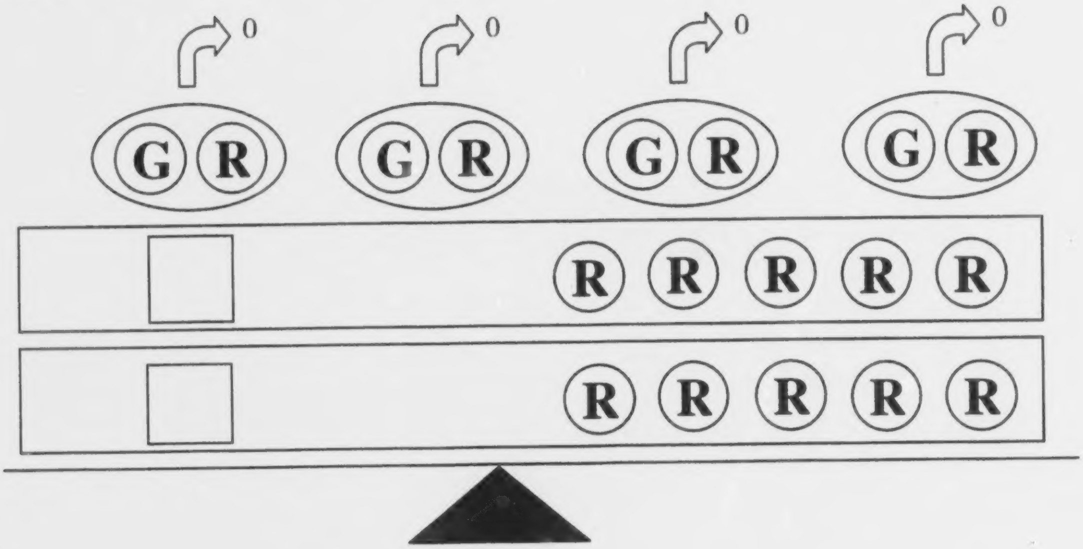
Steps 3-7:


G G R R
G G + R R
R R R R R
R R R + R R

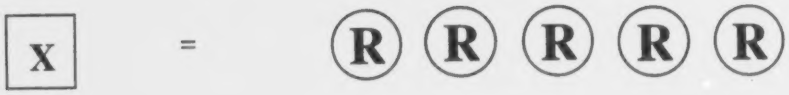
Steps 8-9:


0
0
G R
G R
G R
G R
0
0
R R R R R
R R R R R

Steps 10-15:



Step 16:



$x = -5$

Additional Problems:

1. $(3x + 1) + (x - 5) = 4$ *(Answer: $x = 2$)*
2. $x - (2x + 1) = -3$ *(Answer: $x = 2$)*
3. $3x - 4 = 5x + 3$ *(Answer: $x = -\frac{7}{2}$)*
4. $\frac{1}{2}x + 2 = 5$ *(Answer: $x = 6$)*

Reading/Writing Connection:

Reading Comprehension Standard II, Objective 3: Determine cause and effect.

What effect would the concept of zero pairs have when solving equations like the following?

$2x - 5 = 13$
$3x + 10 = 11$

STANDARD II: The student will be able to solve equations and inequalities.

OBJECTIVE 2: Solve quadratic equations that are factorable.

ELIGIBLE CONTENT:
- Factoring of the type $ax^2 + bx = 0$ may be required.
- The following factoring may be required:
  - difference of two squares
  - greatest common monomial
  - trinomial
  - common binomial

NUMBER OF TEST ITEMS: 4

SUBJECT	LOCATION OF OBJECTIVE WITHIN THE COURSE OF STUDY	PAGE
Algebra I	33. Solve quadratic equations using the zero product property.	83
***Algebra II with Trig.**	27. Solve quadratic equations by using a variety of methods.	97

**Expansion/Review Material*

SUBJECT	PREREQUISITE SKILLS OR RELATED SKILLS FOR THIS OBJECTIVE WITHIN THE COURSE OF STUDY	PAGE
5th Grade Math	42. Develop an understanding of the order of operations.	47
6th Grade Math	41. Demonstrate an understanding of the addition and subtraction properties of equality. 42. Demonstrate an understanding of exponential notation. 43. Extend the understanding of the order of operations.	52 53 53
7th Grade Math	42. Use vocabulary associated with algebra.	59

SUBJECT	PREREQUISITE SKILLS OR RELATED SKILLS FOR THIS OBJECTIVE WITHIN THE COURSE OF STUDY (cont.)	PAGE
8th Grade Math	3. Demonstrate proficiency in evaluating rational number expressions using the order of operations.	62
	5. Demonstrate proficiency in determining least common multiples and greatest common factors.	62
	6. Apply the laws of exponents to simplify expressions containing integral exponents.	62
	33. Develop an understanding of algebraic terms.	66
	36. Solve linear equations and inequalities.	67
	38. Demonstrate proficiency in recognizing the commutative, associative, and identity properties.	67
	39. Use the properties of rational numbers.	67
Introduction To Algebra	3. Apply properties of real numbers.	74
	9. Demonstrate proficiency in simplifying rational number expressions using the order of operations.	74
	10. Demonstrate proficiency in the application of number theory concepts.	75
	12. Apply the laws of exponents to simplify expressions containing rational number exponents.	75
	35. Solve simple linear equations.	77
	37. Use the distributive axiom to factor polynomials.	77
Algebra I	4. Use the order of operations, including exponentiation, to simplify numeric and variable expressions.	80
	6. Apply the number properties.	80
	22. Know and use laws of exponents including zero and negative integral exponents.	82
	25. Factor algebraic expressions.	82
	26. Solve linear equations.	83
***Geometry**	21. Apply properties and theorems related to circles.	89
	33. Solve a problem using ratio or proportion.	90

**Expansion/Review Material*

SUBJECT	PREREQUISITE SKILLS OR RELATED SKILLS FOR THIS OBJECTIVE WITHIN THE COURSE OF STUDY (cont.)	PAGE
*Algebra II with Trig.	4. Perform operations involving polynomials including polynomials with complex coefficients. 9. Determine the nature of the solutions of a quadratic equation. 19. Graph equations of and identify the graphs of conic sections. 26. Express the solutions of equations or inequalities in different ways. 29. Solve word problems that involve linear or quadratic equations. 31. Write polynomial functions given the zeros.	94 94 96 97 97 97
*Advanced Mathematics	34. Solve systems of equations. 35. Apply the Fundamental Theorem of Algebra to solve polynomial equations. 36. Know and apply the Remainder Theorem, the Factor Theorem, the Rational Root Theorem, Descartes' Rule of Signs, and the Location Principle.	107 107 107

*Expansion/Review Material

TEACHER OVERVIEW

Mastery of this objective will require students to be proficient at factoring polynomials, which is covered under Standard I, Objective 4 of the *Alabama High School Graduation Exam*. Under Standard II, Objective 2, students will be required to solve quadratic equations that are factorable.

Strategies and factor patterns used for factoring quadratic equations should be a major focus for this objective. One strategy for solving quadratic equations is the Box Method. The Box Method can be used to factor a quadratic equation and prevent hit or miss guesswork. The Box Method was illustrated and explained in an activity for Standard I, Objective 4 on page C-29. The following activities will assist students in discovering how to solve quadratic equations. To reinforce the learning process, students should be given practice problems that require solving quadratic equations by factoring. The sample problems listed on page C-39 are added because the problems in the activities of this section do not cover the eligible content for this objective. When teaching students how to solve quadratic equations that are factorable, teachers should include and use many other sample problems that cover the eligible content.

Sample Problems:

- Common binomial

  1. Solve for x: $x(x-2)-5(x-2)=0$

     Answer:
     $$\begin{gathered} x(x-2)-5(x-2)=0 \\ (x-2)(x-5)=0 \\ x-2=0 \text{ or } x-5=0 \\ x=2 \text{ or } x=5 \end{gathered}$$

  2. Solve for x: $3x(x-4)+2(x-4)=0$

     Answer:
     $$\begin{gathered} 3x(x-4)+2(x-4)=0 \\ (x-4)(3x+2)=0 \\ x-4=0 \text{ or } 3x+2=0 \\ x=4 \text{ or } x=-2/3 \end{gathered}$$

- Greatest common monomial

  3. Solve for x: $12x^2-15x=0$

     Answer:
     $$\begin{gathered} 12x^2-15x=0 \\ 3x(4x-5)=0 \\ 3x=0 \text{ or } 4x-5=0 \\ x=0 \text{ or } x=5/4 \end{gathered}$$

***Vocabulary*:** monomial, binomial, trinomial, polynomial, quadratic, quadratic term, linear term, constant term

ACTIVITY: Algebra Tiles

Purpose: To allow students to have a visual illustration of how quadratic equations can be modeled using algebra tiles and to provide a visual demonstration for factoring quadratics

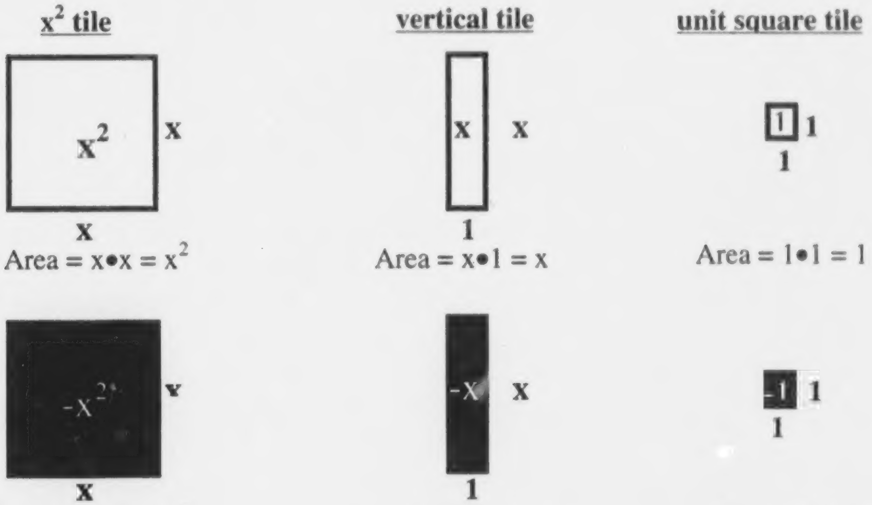
Materials/Equipment:

A classroom set of algebra tiles for multiple groups
(NOTE: An algebra tile set is provided on page C-46. It may be copied for classroom and student use.)

Motivational rewards for group winners
(Examples: candy, pencil, pen)

Instructions for Using Algebra Tiles:

1. Tile Identification: Each size and color of algebra tile represents different expressions. It is important to understand how each tile is identified. Use the illustration below to explain to students what expression each tile size and color represents.



Area = $x \bullet x = x^2$ | Area = $x \bullet 1 = x$ | Area = $1 \bullet 1 = 1$

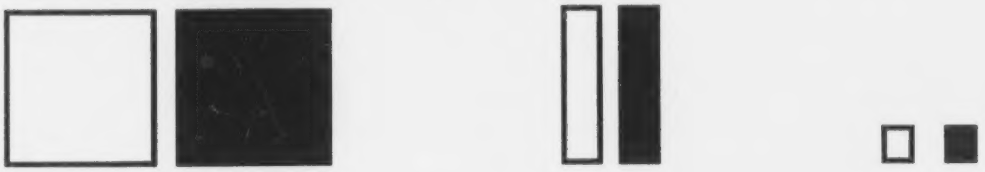
Area = $x \bullet x = x^2$
$x^2 \bullet (-1) = -x^2$

Area = $x \bullet 1 = x$
$x \bullet (-1) = -x$

Area = $1 \bullet 1 = 1$
$1 \bullet (-1) = -1$

(NOTE: The black color indicates a negative tile. Therefore, the area is multiplied by –1 to calculate the expression that the tile represents.)

2. A Zero Pair of Tiles: To work with algebra tiles, a student must understand the concept of a zero pair. A zero pair is any pair of tiles of the same shape but opposite colors. They are called a zero pair because the values of the expressions they represent add up to be zero. Examples of zero pairs are shown below.



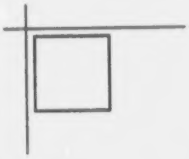
$x^2 + (-x^2) = 0$ $\quad$ $x + (-x) = 0$ $\quad$ $1 + (-1) = 0$

3. The Object of Algebra Tiles: When multiplying two binomials using algebra tiles, the goal is to build a rectangle by using each binomial as the length of one side of the rectangle and then completing the innermost rectangle by adding the necessary tiles. This process was shown in the Standard I, Objective 3 section on multiplying polynomials. Algebra tiles can also be used to illustrate factoring. The process is simply reversed. The goal is to take the tile pieces that represent the equation and form a square. This process was explained in an activity in Standard I, Objective 4. A sample problem is shown in the next step.

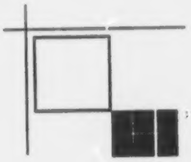
4. Sample Problem: Set up algebra tiles to illustrate $x^2 + x - 6 = (x - 2)(x + 3)$.

a. Start by selecting 1 white x^2 tile to represent x^2, 1 white vertical tile to represent x, and 6 black unit squares to represent – 6.

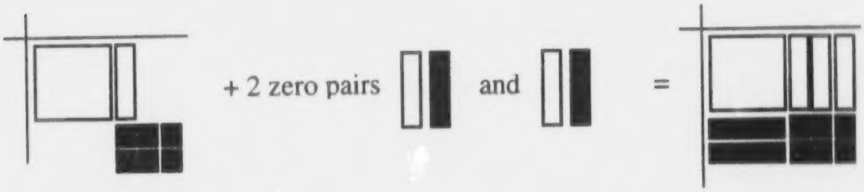
b. On a factor mat or a grid like the one below, place the x^2 tile in the upper left corner.



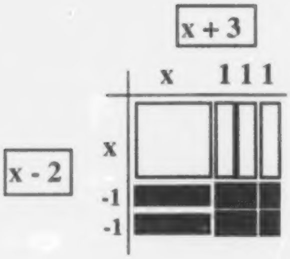
c. Next, form a rectangle with the six black unit squares and place them at the bottom right-hand corner of the x^2 tile as shown below.



d. To complete the rectangle, use the one white vertical tile along with enough zero-pair vertical tiles to fill in the spaces below and to the right of the x^2 tile. This step is shown below.



e. The student will now be able to determine the factors of the equation by labeling the sides of each tile. By adding the expressions that label each tile on one side of the rectangle, the factors are produced. This step is illustrated on page C-42. Notice how all black vertical tiles are grouped together and placed below the x^2 tile while all white vertical tiles must be grouped together and placed to the right of the x^2 tile. This grouping effect is caused by the small 3 x 2 rectangle of the 6 black unit squares. Since there were 3 white vertical tiles, they were put on top of the black unit squares to form the big rectangle properly.



f. The resulting factors can now be used to solve the equation by setting each factor equal to zero and solving for x according to the zero product property.

$$x^2 + x - 6 = 0$$
$$(x + 3)(x - 2) = 0$$
$$x + 3 = 0 \quad \text{or} \quad x - 2 = 0$$
$$x = -3 \quad \text{or} \quad x = 2$$

Procedure:

1. Divide the class into small groups.
2. Provide each group with a set of algebra tiles.
3. If needed, guide the groups through an introductory lesson on algebra tiles by using the explanation found in the *Instructions for Using Algebra Tiles* section. Guide the groups through a few practice problems to familiarize students with algebra tiles.
4. This activity may be used in a competition format. Write a quadratic equation on the board or overhead. The first group to arrange the algebra tiles correctly to express the solutions of the equation could receive a reward; or each problem could count a certain number of points, and the group with the most points after a set number of problems could win a reward. Ten (10) equations that can be used as problems for this activity are shown below.

1. $x^2 + 6x + 8 = 0$
2. $x^2 + 3x - 10 = 0$
3. $x^2 + 8x + 12 = 0$
4. $x^2 + 12x = 0$
5. $x^2 - 10x + 16 = 0$
6. $x^2 - 5x - 6 = 0$
7. $x^2 - 16 = 0$
8. $x^2 - 8x + 15 = 0$
9. $2x^2 + 9x + 10 = 0$
10. $2x^2 + 5x = 12$

Questions:

1. What relationship of the tiles is being used to show the factors of polynomials? *(Answer: Area)*
2. Explain how area is involved in the use of algebra tiles? *(Possible response: The area of a rectangle is found by multiplying the length times the width.)*
3. What determines whether positive and/or negative tiles should be used? *(Answer: The sign of the coefficients in the equation determine this. For example: The equation* $x^2 - 5x - 6 = 0$ *would begin with 6 negative unit square tiles and one positive* x^2 *tile. The 5 negative x tiles would result by correctly setting up the proper rectangle as shown in the example.)*

Reading/Writing Connection:

Reading Comprehension Standard II, Objective 3: Determine cause and effect.
Reading Comprehension Standard II, Objective 2: Draw conclusions.

1. Cause and Effect: Ask students to explain in a paragraph why the area of a rectangle created by algebra tiles causes the tiles to illustrate the product of polynomials as factors of a quadratic equation.

2. Draw Conclusions: Give several word problems to students. Tell them to read the problems and determine the polynomial that best represents the solution to each problem.

   SAMPLE: The sum of a number and its square is 30.
   A. $x^2 + x = 30$ B. $x + 2x = 30$ C. $x^2 + 30x = 1$ D. $30(x^2 + x) = 1$

   After determining the correct equation, students could then be asked to factor and solve the equation.

ACTIVITY: The Great Solution Hunt

Purpose: To provide students with a "hands-on" activity that will assist in practicing and reviewing solutions to quadratic equations

Materials/Equipment:

Index cards
Paper and pencil

Procedure:

1. Prepare index cards by writing an equation or a solution on each card. Make sure that each solution card matches only one equation card. A sample set is shown on page C-44.

SAMPLE CARD SET:

$x^2-2x-3=0$	$x = 3$	$x = -1$

OTHER POSSIBLE EQUATIONS AND SOLUTIONS FOR CARD SETS:

EQUATION	SOLUTION	
	#1	#2
$x^2 - 25 = 0$	$x = 5$	$x = -5$
$x^2 + 4x + 4 = 0$	$x = -2$	$x = -2$
$x^2 + 6x - 7 = 0$	$x = 1$	$x = -7$
$x^2 - 10x + 24 = 0$	$x = 4$	$x = 6$
$x^2 - 12x + 20 = 0$	$x = 10$	$x = 2$
$x^2 + 11x + 24 = 0$	$x = -3$	$x = -8$
$x^2 + 14x + 40 = 0$	$x = -4$	$x = -10$
$x^2 - 2x - 48 = 0$	$x = -6$	$x = 8$
$x^2 - 7x = 0$	$x = 7$	$x = 0$

NOTE: Teachers should try to make the card sets so that the same solution matches only one equation. Confusion may result if a student finds solutions that satisfy more than one equation. However, this fact could be an excellent opportunity for class discussion.

2. Hand each student one card with either an equation or a solution on the card. Ask students with equation cards to decide what the solutions would be. Ask students with solution cards to think of possible factors and equations that would give their solutions.
3. Tell the students:
    - Students who have an equation card should "hunt" for the student who has the solution to the equation. Example: If a student has the equation card with: $x^2 - 4 = 0$, then the student would try to find other students with the solution cards $x = 2$ and $x = -2$.
    - Students who have a solution card should "hunt" for the student who has an equation that is satisfied by the solution on the card.
4. Have students walk around the room to "hunt" for the solution or equation card that matches their card by comparing cards with other students.
5. Say: "Begin the hunt."
6. A group is formed when a student with an equation card finds a student having a solution to his or her equation.
7. The group should then sit down and write the equation and the steps that verify the solutions are correct.
8. Another round can be played if more cards are available.
9. Papers verifying solutions to equations and cards should be turned in when all rounds have been played.

Questions:

1. Describe how the group found each other. *(Possible responses: factored and solved, substitution, guessed)*
2. What methods were used to determine if a solution card matched an equation card? *(Possible responses: factored and solved, substitution, quadratic formula)*
3. Could another equation have been given that would have a solution used in the group's equation? *(Yes, because a solution such as $x = 2$ that comes from the factor $(x - 2)$ could be paired with another factor other than $(x - 10)$ as given in the chart on page C-44. For example, $x = 2$ is also a factor of $x^2 - 4 = 0$.)*
4. If the answer is yes in question 3, write an example of another equation that has one of the group's solutions but not the other. *(Answers will vary depending on the group's solutions. An example answer for the equation card: $x^2 - 7x = 0$ with solutions $x = 7$ and $x = 0$ would be to write the equation $x^2 + 5x = 0$ that also has $x = 0$ as a solution.)*

NOTE: Although the quadratic formula will not be needed, teachers may want to remind students that all quadratic equations can be solved by using the quadratic formula.

THE QUADRATIC FORMULA

$$x = \frac{-b \pm \sqrt{b^2 - 4ac}}{2a}$$

Reading/Writing Connection:

Reading Comprehension Standard I, Objective 2: Determine sequence of events.

Reading Comprehension Standard IV, Objective 2: Demonstrate the ability to preview and predict.

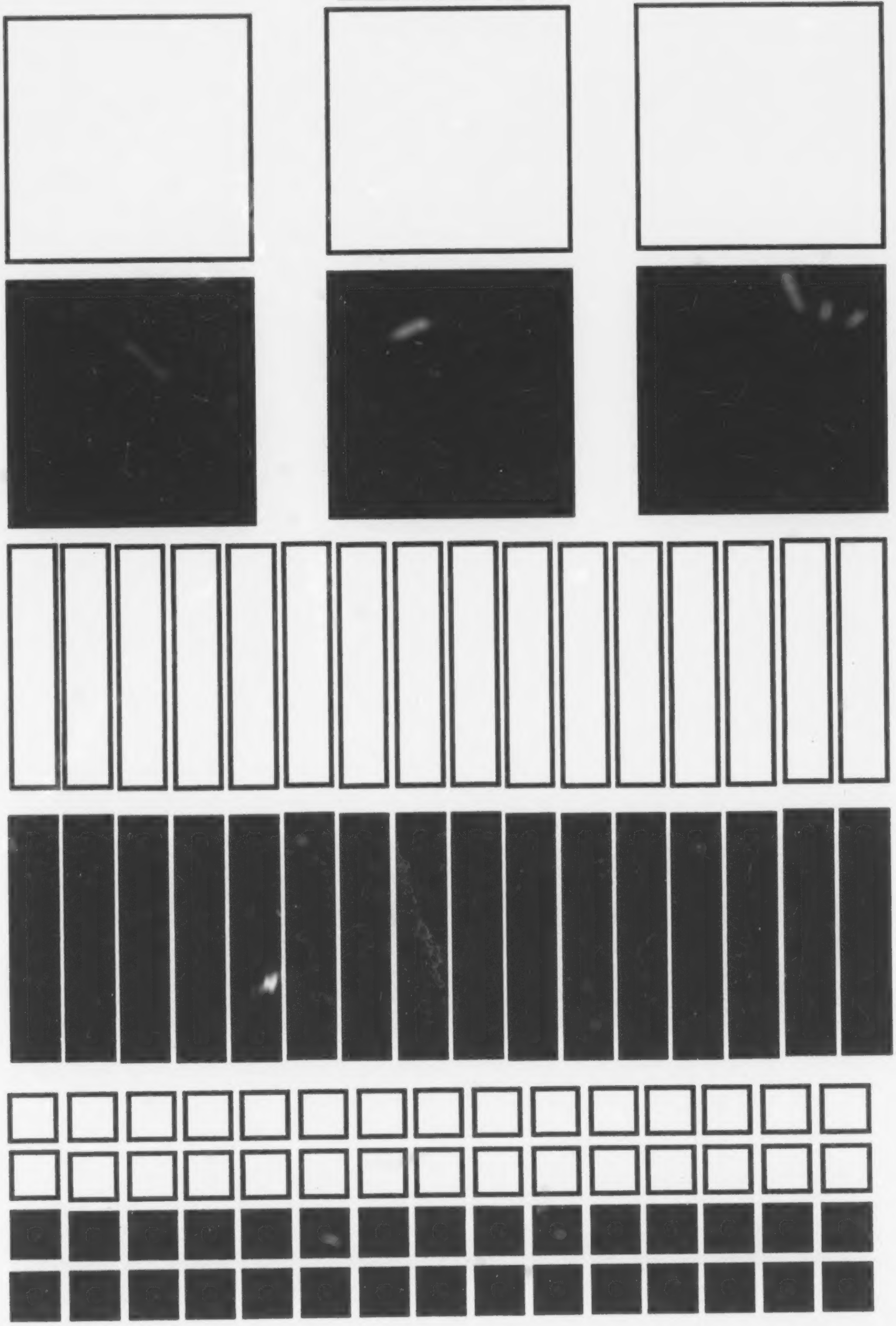
1. Sequencing - Ordering: Have students solve or think about the steps involved in solving a quadratic equation. Ask them to write, in sequential order, a description for each step involved in the solution of the quadratic equation.

2. Predicting: Give students several quadratic equations. Ask them to predict possible factors and then write an explanation for their predictions.

ADDITIONAL RESOURCES

1. Algebra Mods, Brad and Bonny Davidson, from Educational Teaching Aids (ETA®), a division of A. Daigger and Co. Inc., Vernon Hills, IL 60061.
2. *Basic Algebra,* Jerome D. Kaplan, Ed. D, Educational Design, Inc., 1996.
3. *Key to Algebra – Polynomials,* Julie King and Peter Rasmussen, Key Curriculum Press, ISBN 1 –55953-004-9.

ALEBRA TILE SET



STANDARD II: **The student will be able to solve equations and inequalities.**

OBJECTIVE 3: **Solve systems of two linear equations.**

ELIGIBLE CONTENT:
- **Solving for the values of both x and y may be required.**
- **The options may be four graphs with lines plotted and the intersection point labeled with its ordered pair.**

NUMBER OF TEST ITEMS: 4

SUBJECT	LOCATION OF OBJECTIVE WITHIN THE COURSE OF STUDY	PAGE
Algebra I	19. Graph systems of linear equations. 26. Solve linear equations. 31. Solve systems of linear equations.	82 83 83
***Algebra II with Trig.**	29. Solve word problems that involve linear or quadratic equations. 32. Solve systems of equations or inequalities. 33. Use Cramer's Rule to solve systems of equations in two or three variables.	97 97 97
***Advanced Math**	34. Solve systems of equations.	107

**Expansion/Review Material*

SUBJECT	PREREQUISITE SKILLS OR RELATED SKILLS FOR THIS OBJECTIVE WITHIN THE COURSE OF STUDY	PAGE
5th Grade Math	40. Recognize that two equivalent quantities remain equal when the same change takes place on each quantity.	47
6th Grade Math	41. Demonstrate an understanding of the addition and subtraction properties of equality.	52
7th Grade Math	46. Solve linear equations of the type $ax + b = c$.	59
8th Grade Math	31. Identify and graph functions on the Cartesian plane. 36. Solve linear equations and inequalities.	66 67

SUBJECT	PREREQUISITE SKILLS OR RELATED SKILLS FOR THIS OBJECTIVE WITHIN THE COURSE OF STUDY (cont.)	PAGE
Introduction to Algebra	23. Graph linear functions in the form y = mx + b on the Cartesian plane. 35. Solve simple linear equations.	76 77
***Algebra II with Trig.**	26. Express the solutions of equations or inequalities in different ways.	97

**Expansion/Review Material*

TEACHER OVERVIEW

Students should know how to solve simple equations and how to use substitution before going on to solve systems of equations. Students must become familiar with the substitution, graphing, addition, and multiplication-with-addition methods of solving systems of equations.

ACTIVITY: Solving Systems of Equations with Equation Mats

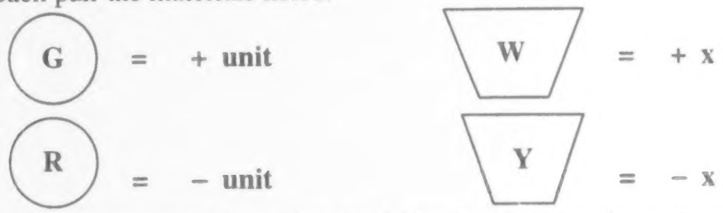
Purpose: To help students demonstrate knowledge of solving systems of equations with the use of equation mats

Materials/Equipment (per group):

1 equation mat or 1 sheet of typing paper
10 cups (5 white and 5 yellow)
25 counters or circles (15 green and 10 red)
Paper and pencil

Procedure:

1. Pair each student with a partner.
2. Give each pair the materials listed.



3. Students will use a model to solve the following system of equations.

$y = x - 1$
$x + y = 3$

4. Have the students let a white cup represent the unknown value of x.
   Ask students: If $y = x - 1$, how can y be represented? *(Answer: 1 white cup and 1 red counter)*
5. Next, let the students represent $x + y = 3$ on the equation mat. On one side of the mat, place one cup to represent x and one representation of y from Step 4. On the other side of the mat, have the students place three positive counters. *(Answer: 1 white cup + 1 white cup + 1 red counter = 3 green counters)*
6. Tell students to use their previous knowledge about equation mats and zero pairs to solve the equation. Ask students to find the value of x that would give the solution for the system of equations. *(Answer: 2 white cups + 1 red counter + 1 green counter = 3 green counters + 1 green counter. Since 1 red counter + 1 green counter = 0, the equation above becomes 2 white cups = 4 green counters. This means 1 white cup = 2 green counters. Thus: $x = 2$)*
7. Use the value of x from Step 6 and the equation $y = x - 1$ to find the value of y.
   (Answer: $y = 2 - 1$, so $y = 1$)
8. What is the solution of the system of equations? *[Answer: (2,1)]*
9. Have students follow the same steps given above to solve the following problems.
   Let students then transfer this knowledge to pencil and paper and explain the concepts involved in the method used to obtain the answer.

(a) $4x + y = 15$
$y = 3x - 13$
[Answer: (4,–1)]

(b) $x + y = 5$
$y - 4x = 0$
[Answer: (1,4)]

(c) $x + 2y = -7$
$-4x - y = 0$
[Answer: (1,– 4)]

Reading/Writing Connection:

Reading Comprehension Standard I, Objective 3: Follow directions.
Reading Comprehension Standard II, Objective 2: Draw conclusions.

Students will read problems and discuss with their partners the methods for using the equation mat to solve a given system of equations. When they agree on a method, they will demonstrate the solution using the equation mat. Students will transfer the problem from the mat to pencil-and-paper calculations. They will write a sequential explanation of their solution. This written solution will be given to another group. The new group will follow the written directions and determine whether the procedure directs them to the same solution.

ACTIVITY: Using Graphing Calculators to Solve Systems of Equations

Purpose: To serve as an introductory activity for solving multi-step inequalities *(NOTE: Graphing calculators cannot be used on the Alabama High School Graduation Exam. This activity can be used for discovery and expansion purposes, but students must be able to solve systems of equations without the aid of graphing calculators.)*

Materials/Equipment:

Graphing calculators
Pencil and paper (for each pair of students)

Procedure:

1. Pair students. Give each pair of students a graphing calculator.
2. Review procedures for using graphing calculators with students. Go over the different graphing options and graphing terms as a review. (Though graphing calculators may differ in the functions or keys, most will contain the features used in the following steps.)
3. Tell the students that they are going to solve the following system of equations.

   $y = x + 7$
   $y = -x + 9$
4. Instruct the class to begin by graphing the equations in the standard viewing window.
5. Instruct the students to notice that the graphs intersect at a point. Ask students to name the quadrant in which this point is found. ***(Answer: Quadrant I)***
6. Let students use the ***TRACE*** function and the arrow keys to determine the coordinates of the point of intersection. Have students repeat this process as many times as necessary to get a more accurate answer.
7. Tell students that they may also use the ***INTERSECT*** feature to find the coordinates of the point of intersection.
8. Tell students to determine the point of intersection. Explain to the students that this is the solution to the system of equations. *[Answer: (1,8)]*
9. Let students use the graphing calculators to complete the following problems. Have students transfer this knowledge to pencil and paper.

   (a). $x + y = 27$
   $3x - y = 41$
   [Answer: (17,10)]

   (b). $2x + 7y = 3$
   $x = 1 - 4y$
   [Answer: (5,–1)]

   (c). $x + y = 5$
   $3x - y = 3$
   [Answer: (2,3)]

10. Take up the graphing calculators.
    a. Tell students to solve several more problems like those in Step 9 without the aid of calculators.
    b. Give students four graphs and one system of linear equations. Each graph should contain two intersecting lines. One graph should contain the solution to the system of equations. The points of intersection of the two lines on all four graphs should be labeled. Ask students to determine which graph illustrates the solution of the system of equations.

Reading/Writing Connection:

Reading Comprehension Standard I, Objective 3: Follow directions.
Reading Comprehension Standard II, Objective 2: Draw conclusions.

Students will be able to follow instructions on the use of graphing calculators. They also will be able to read and discuss how to transfer knowledge gained using the graphing calculators to pencil-and-paper calculations.

STANDARD II: **The student will be able to solve equations and inequalities.**

OBJECTIVE 4: **Solve multi-step inequalities of first degree.**

ELIGIBLE CONTENT: • **A negative coefficient may be used.**

NUMBER OF TEST ITEMS: 4

SUBJECT	LOCATION OF OBJECTIVE WITHIN THE COURSE OF STUDY	PAGE
7th Grade Math	47. Solve linear inequalities of the type ax + b > c and graph the solution set on a number line.	59
8th Grade Math	36. Solve linear equations and inequalities.	67
Algebra I	30. Solve linear inequalities.	83
***Algebra II with Trig.**	26. Express the solutions of equations or inequalities in different ways. 32. Solve systems of equations or inequalities.	97 97

**Expansion/Review Material*

SUBJECT	PREREQUISITE SKILLS OR RELATED SKILLS FOR THIS OBJECTIVE WITHIN THE COURSE OF STUDY	PAGE
5th Grade Math	40. Recognize that two equivalent quantities remain equal when the same change takes place on each quantity.	47
6th Grade Math	41. Demonstrate an understanding of the addition and subtraction properties of equality.	52
8th Grade Math	37. Use linear equations and inequalities to solve problems.	67
Introduction to Algebra	34. Determine equations or inequalities that represent problem situations.	77
***Algebra II with Trig.**	28. Identify equations or inequalities that represent problem situations.	97

**Expansion/Review Material*

SUBJECT	PREREQUISITE SKILLS OR RELATED SKILLS FOR THIS OBJECTIVE WITHIN THE COURSE OF STUDY (cont.)	PAGE
***Advanced Mathematics**	50. Use trigonometric equations and inequalities to solve word problems.	108

**Expansion/Review Material*

TEACHER OVERVIEW

Students should know how to solve simple inequalities before going on to multi-step inequalities. Students must also be familiar with setting up word problems.

ACTIVITY: Multi-Step Inequalities*

* This activity is adapted from an example included in *Glencoe Algebra I,* Glencoe/McGraw-Hill, 1998, pp. 407-408. It is used with the permission of Glencoe/McGraw-Hill.

Purpose: To serve as an introductory or discovery activity for solving multi-step inequalities

Materials/Equipment:

Paper and pencil

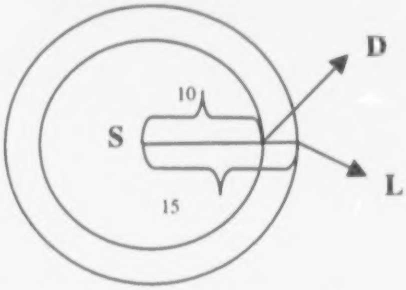
Procedure:

Scenario: Danielle and Lucinda are on the track team at their school. Each day they practice at their school. Danielle lives 10 miles from the school, and Lucinda lives 15 miles from the school.

Question: How far do Danielle and Lucinda live from each other?

1. Divide the class into small groups. (Groups of three students work well.) Ask students to examine how they would determine the distance between Danielle's and Lucinda's homes.
2. Tell students to explore the problem. Determine the relative positions of Danielle's house and Lucinda's house in relation to the school.
3. Have the students plan the problem by drawing a diagram of the situation.
   Let ***S*** represent the location of the school, ***D*** represent Danielle's home, and ***L*** represent Lucinda's home. Let two circles with radii of 10 and 15 represent possible locations for both homes. (Some students will draw the diagram using the same line for both radii, while others may represent the distance using opposite radii or two separate radii. This leads to the discussion of possible solutions.)

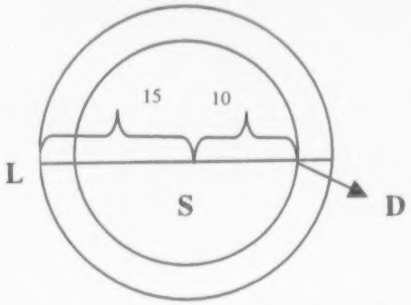
4. Have students solve the problem by examining the following possibilities for the locations of Danielle's and Lucinda's homes.
   a. Danielle and Lucinda live along the same radius from the school.



The same radius

(The distance is 15 – 10 or 5 miles.)

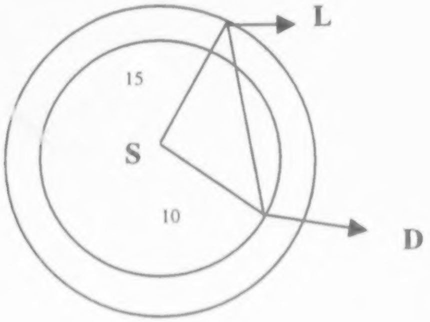
   b. Danielle and Lucinda live on opposite radii from the school.



Opposite radii

(The distance is 15 + 10 or 25 miles.)

   c. Danielle and Lucinda live somewhere other than the locations described in (a) and (b).

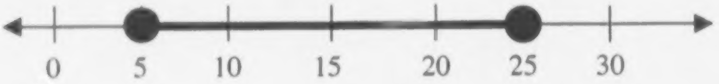


Somewhere other than (a) or (b)

The Triangle Inequality Theorem states: If three line segments form a triangle, then the sum of the lengths of any two sides must exceed the length of the third side. In the triangle above, the distance from **L** to **D** must be less than 25 miles (15 + 10) and greater than 5 miles.

5. Using ***d*** as the distance, have students determine an inequality that represents all the situations illustrated in the three diagrams.
   ($5 \le d \le 25$)

6. Have students graph their answers.

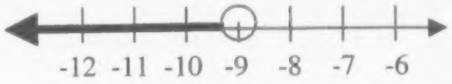


7. Finally, let the students examine the results of the three possibilities and discuss the outcomes with the class.

8. Review a multi-step inequality problem with students.

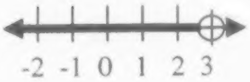
Example: $9r + 15 > 24 + 10r$	$9r + 15 > 24 + 10r$
a. Isolate the variable term on one side of the equation.	
• Combine like terms by subtracting 10r on both sides.	$9r+15-10r > 24+10r-10r$ $-r + 15 > 24$
• Subtract 15 from both sides of the equation.	$-r +15-15 > 24 - 15$
• Simplify.	$-r > 9$
b. Divide by –1 on both sides of the equation.	$(-r) \div (-1) < (9) \div (-1)$
(When dividing by a negative, change the direction of the inequality.)	$r < -9$

Have students graph the answer: $r < -9$.

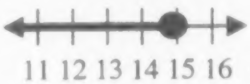


9. Using methods learned to solve multi-step inequalities, students may solve the following practice problems and graph each answer.

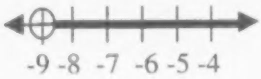
(a) $2y + 10 < 16$
[Answer: ($y < 3$)]



(b) $4p + 70 \le 130$
[Answer: ($p \le 15$)]



(c) $8n + 2 - 10n < 20$
[Answer: ($n > -9$)]



10. Have students discuss what the outcome of each problem represents.

Reading/Writing Connection:

Reading Comprehension Standard I, Objective 3: Follow directions.
Reading Comprehension Standard II, Objective 2: Draw conclusions.

Have students read and discuss similar problem scenarios with their group. Write possible solutions to each problem in sequential steps. Follow the directions in each step to determine the outcome. Describe the outcome orally to the class and give each group points when classmates can follow the written directions and derive the correct outcome.

ADDITIONAL RESOURCES

Glencoe Algebra I, William Collins et al., Glencoe/McGraw-Hill, New York, 1998.

STANDARD III: **The student will be able to apply concepts related to functions.**

OBJECTIVE 1: **Identify functions.**

ELIGIBLE CONTENT:

- **The options may be graphs, ordered pairs, tables, or mappings.**
- **The options may be equations when given a table of values or ordered pairs.**
- **The options may be tables of values or ordered pairs when given an equation.**
- **Functions may be expressed using either the terminology "$f(x) =$" or "$y =$".**

NUMBER OF TEST ITEMS: 4

SUBJECT	LOCATION OF OBJECTIVE WITHIN THE COURSE OF STUDY	PAGE
7th Grade Math	40. Determine a rule that represents a function relationship.	59
8th Grade Math	31. Identify and graph functions on the Cartesian plane. 32. Develop an understanding of rules that represent patterns or relationships that are functions.	66 66
Introduction to Algebra	28. Identify equations of functions that represent data given in a table. 32. Determine rules that represent patterns or functions.	76 77
Algebra I	36. Determine whether or not relations are functions, given graphs, tables of values, or sets of ordered pairs. 40. Identify graphs of functions, given data in tables or equations.	83 84
*** Algebra II with Trig.**	17. Graph basic equations and identify the graphs of basic equations in the coordinate plane. 34. Identify equations or graphs of functions from given tables of values.	95 98
***Advanced Mathematics**	27. Identify functions from tables of values or graphs.	106

**Expansion/Review Material*

SUBJECT	PREREQUISITE SKILLS OR RELATED SKILLS FOR THIS OBJECTIVE WITHIN THE COURSE OF STUDY	PAGE
5th Grade Math	38. Find the output of functions (number machines).	46
6th Grade Math	39. Find the output of functions (number machines).	52
7th Grade Math	39. Find the output of functions (function machines). 41. Identify the domain and range of a function.	59 59
8th Grade Math	28. Identify components of the Cartesian plane. 30. Use computers and graphing calculators to facilitate understanding of coordinate geometry.	65 66
Introduction to Algebra	20. Demonstrate proficiency in using vocabulary and basic concepts related to the coordinate plane. 30. Describe and represent relationships with tables, graphs, and rules. 31. Make predictions from data in a table.	76 77 77
Algebra I	15. Graph and identify graphs of common relations.	81
***Advanced Mathematics**	26. Graph rational functions using intercepts, symmetry, and asymptotes (vertical, horizontal, and oblique). 28. Analyze the effects of parameter changes on the graphs of functions. 29. State the properties of functions.	106 106 106

**Expansion/Review Material*

TEACHER OVERVIEW

Students must have a thorough understanding of the definition of a function in order to identify a function. This includes being familiar with vocabulary related to functions.

Vocabulary: relation, function, domain, range, input variable, output variable, mapping, ordered pair, and vertical line test

Definitions:

Relation: a set of ordered pairs (x,y)

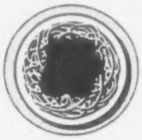
Function of x:	a relation in which no two ordered pairs have the same x-value and different y-values
Vertical Line Test:	states that the graph of a function cannot be intersected by any vertical line at more than one point

Explain to students that a function is like a machine. A machine performs a certain task. When all of the components the machine needs to operate are provided, then the machine performs the task it was designed to perform. The end result is the product the machine was designed to produce. All machines operate under this input-output premise.

Functions operate like machines. As a value is supplied as input for a given function and the components of the function are evaluated correctly, the output will be the same result each time. In other words, each x-value will have only one y-value.

ACTIVITY: Spaghetti Function

THE SPAGHETTI FUNCTION...



Purpose: To use spaghetti to identify a function

Materials/Equipment:

Graph paper
Long dry spaghetti (a straight edge may be used)
Teacher-prepared list of sets of ordered pairs
Mapping and equations

Procedure:

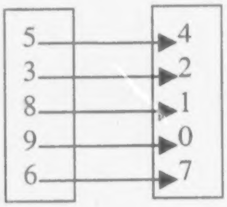
1. Divide the class into small cooperative groups. Each group should have sheets of graph paper, a long dry piece of spaghetti, and a list of several sets of ordered pairs such as {(0,1), (1,2), (1,3), (2,4), (3,5), (4,5)}. Some sets should represent functions, and others should not.
2. After discussing the definitions of a relation and a function, have students identify each set of ordered pairs as a relation or function.
3. Students should then plot each set of ordered pairs.
4. Using the piece of spaghetti as a vertical line, the students can use the vertical line test to verify visually whether the graph of each set of points is a function or just a relation.
5. Give each group a list of equations in two variables (x and y) and the graph of each equation.
6. Have the students identify each equation as a function by examining the graph using the piece of spaghetti and the vertical line test.

7. Once equations are identified as functions, ask the students to express them as "y =" and as "$f(x)$ =".
8. Students could also be given graphs without the corresponding equation and asked to identify those that are functions.

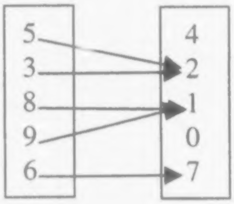
Additional Problems:

1. Similar activities may be done using graphing utilities such as graphing calculators or computers.
2. Worksheets, including mappings or tables of values, could be given to students to identify as functions.

Example:



Function



Not a function

Questions:

1. When are relations also functions? *(Answer: When they satisfy the definition of a function)*
2. What rules are used to identify functions? *(See the definition and the vertical line test.)*

Reading/Writing Connection:

Reading Comprehension Standard II, Objective 2: Draw conclusions.
Reading Comprehension Standard IV, Objective 3: Discern organization patterns.

Have students write a paragraph answering these questions.

- How are a relation and a function the same?
- How are they different?

STANDARD III: **The student will be able to apply concepts related to functions.**

OBJECTIVE 2: **Find the range of functions when given the domain.**

ELIGIBLE CONTENT:
- **The domain of a function may be a single value or a set of values.**
- **A set of ordered pairs may be used.**
- **Functions may be expressed using either the terminology "*f*(x) =" or "y =".**

NUMBER OF TEST ITEMS: 4

SUBJECT	LOCATION OF OBJECTIVE WITHIN THE COURSE OF STUDY	PAGE
7th Grade Math	39. Find the output of functions (function machines). 41. Identify the domain and range of a function.	59 59
Algebra I	38. Evaluate functions for given values in their domains.	83
***Algebra II with Trig.**	35. Identify the domain and range of functions.	98

**Expansion/Review Material*

SUBJECT	PREREQUISITE SKILLS OR RELATED SKILLS FOR THIS OBJECTIVE WITHIN THE COURSE OF STUDY	PAGE
5th Grade Math	38. Find the output of functions (number machines). 42. Develop an understanding of the order of operations.	46 47
6th Grade Math	39. Find the output of functions (number machines). 43. Extend the understanding of the order of operations.	52 53
7th Grade Math	37. Demonstrate proficiency in the use of the order of operations. 40. Determine a rule that represents a function relationship.	58 59
8th Grade Math	32. Develop an understanding of rules that represent patterns or relationships that are functions.	66

SUBJECT	PREREQUISITE SKILLS OR RELATED SKILLS FOR THIS OBJECTIVE WITHIN THE COURSE OF STUDY (cont.)	PAGE
Introduction To Algebra	32. Determine rules that represent patterns or functions. 33. Evaluate algebraic expressions.	77 77
Algebra I	21. Evaluate algebraic expressions. 37. Recognize domain and range of relations, given graphs, tables of values, or sets of ordered pairs.	82 83
***Algebra II withTrig.**	36. Perform operations on functions.	98
***Advanced Mathematics**	29. State the properties of functions.	106

**Expansion/Review Material*

TEACHER OVERVIEW

Students must be able to find elements of the range of a function when given the domain by using substitution and the order of operations correctly. They should understand that solutions to functions could be given in ordered pair form. They should know that the *f*(x)-value is the same as the y-value, which is an element of the range. Remember that "*f*(4)" means to evaluate using the number 4 for the value of x.

Vocabulary: function, domain, range, input variable (x), output variable (y), "*f*(x)", ordered pair (x,y), independent variable, dependent variable

ACTIVITY: Making a Function Machine*

Purpose: To use note cards to make a function machine that will help students understand the process of using the domain to find the range

Materials/Equipment:

4 x 6 note cards
Scissors
Straight edge
Template for note cards

Procedure:

1. Divide the class into groups of two. Give each pair two blank 4 x 6 inch note cards.
2. The students should draw three boxes near the center of the card. Cut out the squares on the left and on the right. Label the left "window" INPUT and the right "window" OUTPUT. Explain that these windows represent the independent and dependent variables. *(See template included at the end of III-2 for example.)*
3. In the middle box, have the students write a function rule. *(Example: 4x – 3)*
4. On the other card, have the students write the numbers –5 to 5 in a column one-half inch from the left edge.
5. Using the first card as a function machine, place it over the number column so that –5 appears in the INPUT window. Students should perform the operation in the center box and write the output in the right window. Slide the function machine down so that the input is –4 and write the output. Continue this process for all 11 input and output values.

Questions:

Which variable, x or y, is the input? *(Answer: x)* Which is the output? *(Answer: y)*

(Used by permission of Jacksonville State University Inservice Education Center)*

ACTIVITY: The Human Function Machine

Purpose: To allow students to become function machines and evaluate functions

Materials/Equipment:

Counters (almost anything can be used)
Teacher-prepared worksheet of functions

Procedure:

1. Divide the class into groups of two. Give each group several counters (Ex: M&M's®, beans, or purchased counters). Each pair should also receive a worksheet of simple functions. *(M&M's® is a registered trademark of Mars, Incorporated.)*
2. One student, acting as the human function machine, will be given 1-10 counters by the other student to use as input into a function.
3. The human function machine will determine the output of the function using additional counters. For example, in the function $f(x) = 2x + 5$, the "machine" will double that number of counters and add five more to determine $f(x)$, the output. In this example, when 3 counters are given, the machine calculates $2 \bullet 3 + 5 = 11$.
4. The students will alternate playing the part of the function machine using different functions from the worksheet.

ACTIVITY: Game of Functions

Purpose: To allow students to play a game that will strengthen their ability to evaluate functions

Materials/Equipment:

A deck of 3 x 5 note cards prepared with functions on them
Number cubes

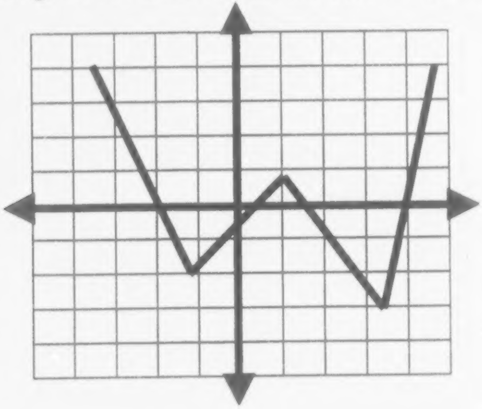
Procedure:

1. Divide the class into groups of two. Give each group ten or more 3 x 5 note cards prepared with a function on each and a number cube or die.
2. The students will divide the cards evenly. One person will roll the cube, and each student will turn one of his or her function cards face up. Using the number on the cube, each student will evaluate his or her function. The student with the highest output value wins that round and gets both cards.
3. Students should repeat Step 2 until all function cards have been used. The student with the most cards at the end wins the game. Players should then reshuffle the cards and play again. The player winning two of three games wins the match.

Additional Problems Related to this Objective:

1. Teachers should also provide worksheets and exercises that require students to identify the range of a function from the graph of the function.

   Example: What is the range of the function shown below? *(Answer: $-3 \le y \le 4$)*



2. Give students a set or ordered pairs. Ask the students to identify the range.

   Example: $\{(1,2), (-3,4), (6,3), (0,5)\}$
   Range = $\{2, 3, 4, 5\}$

Reading/Writing Connection:

Reading Comprehension Standard I, Objective 2: Determine sequence of events.
Reading Comprehension Standard I, Objective 3: Follow directions.

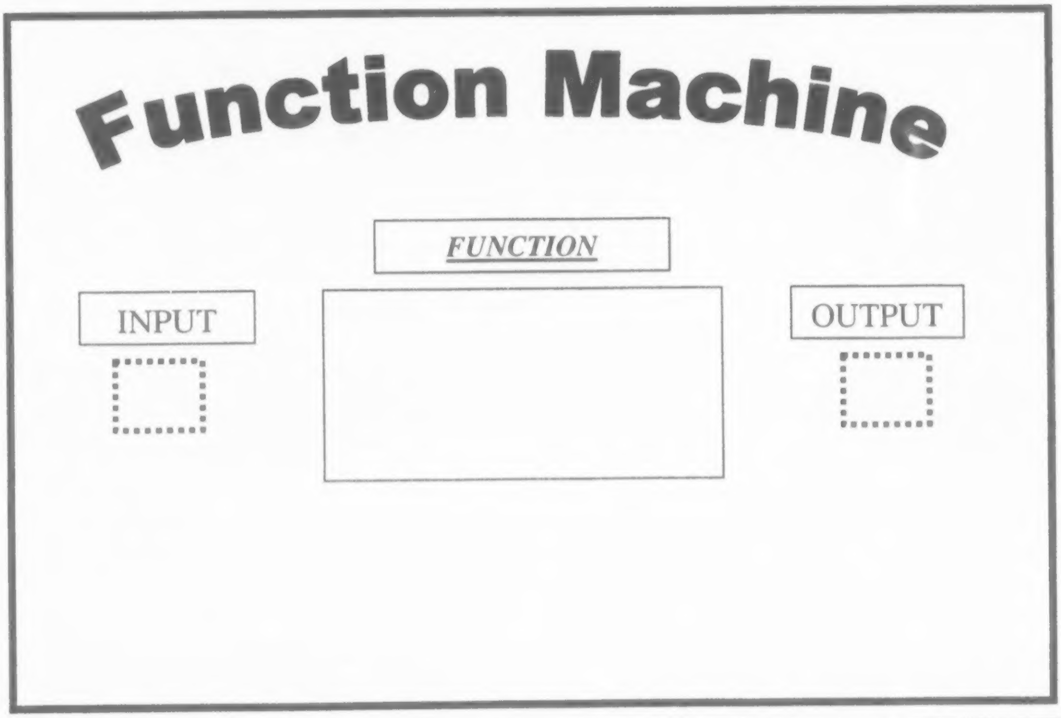
Have students write a paragraph explaining the step-by-step process for evaluating specific functions.

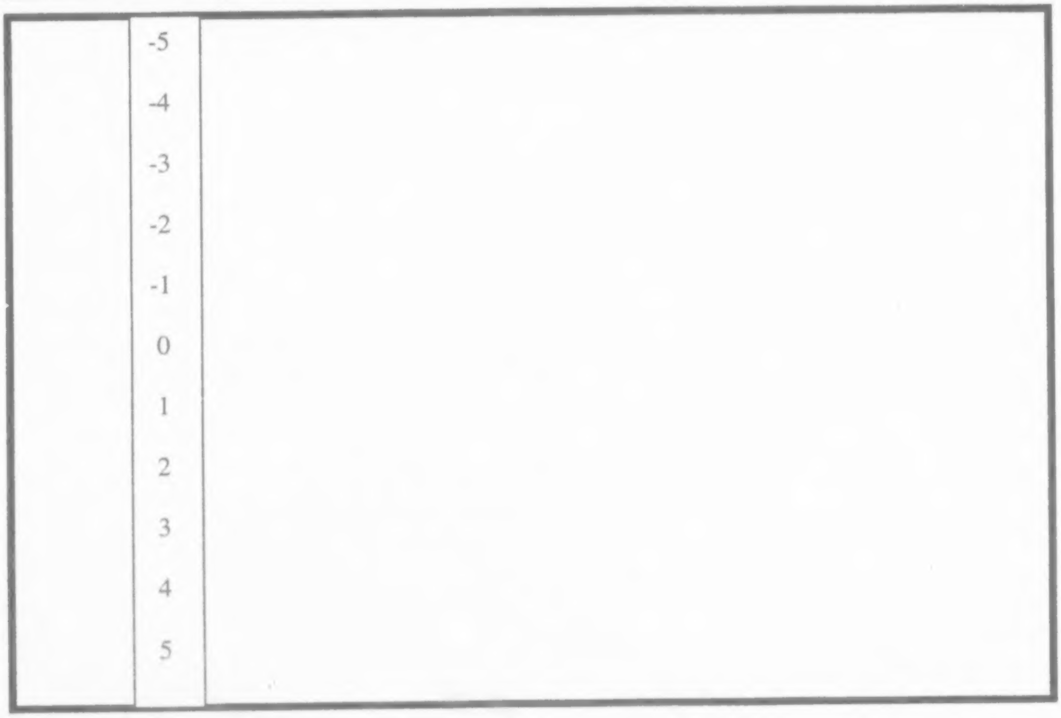
Example: Given: $f(x) = 3x - 6$
Find: $f(4)$

Sample answer:

To evaluate this function, first substitute 4 for the value of x. Next, multiply 3 times 4 (the value of x) and obtain a product of 12. The function requires 6 to be subtracted from the value of 3x. Therefore, subtract 6 from 12 to yield a result of 6. Finally, the value of $f(4)$ is equal to 6.

Function Machine Template on 4 x 6 Note Card


Function Machine
FUNCTION
INPUT
OUTPUT


-5
-4
-3
-2
-1
0
1
2
3
4
5

STANDARD IV: **The student will be able to apply formulas.**

OBJECTIVE 1: **Find the perimeter, circumference, area, or volume of geometric figures.**

ELIGIBLE CONTENT:

- **The value of pi (π) will be 3.14.**
- **Options may be left in terms of π.**
- **Unnecessary dimensions may be included.**
- **Drawings may be used.**
- **Finding volume or surface area of a rectangular prism may be required.**
- **Extracting a square root may be required.**
- **Determining the area of a circle when given the diameter in the drawing may be required.**
- **The formulas will be given in the problems.**

NUMBER OF TEST ITEMS: 4

SUBJECT	LOCATION OF OBJECTIVE WITHIN THE COURSE OF STUDY	PAGE
7th Grade Math	22. Solve real-life measurement problems. 23. Exhibit proficiency in determining perimeter and area of regular plane geometric figures. 24. Apply appropriate formulas to find perimeter, circumference, surface area, area, and volume.	57 57 57
8th Grade Math	17. Solve measurement problems by using mental math, paper and pencil, and estimation techniques as well as appropriate units of measure. 18. Demonstrate proficiency in measuring to find perimeter, area, and volume using customary and metric units. 27. Determine measures associated with plane and solid geometric figures using given formulas.	64 64 65
Introduction to Algebra	19. Given the formulas, use perimeter, area, surface area, circumference, or volume of geometric figures to solve problems.	76
Algebra I	8. Apply the perimeter and area of a polygon to solve problems, given the formulas. 9. Determine the volume and surface area of geometric solids, given the formulas. 10. Solve problems involving the area and circumference of a circle, given the formulas.	80 81 81

SUBJECT	LOCATION OF OBJECTIVE WITHIN THE COURSE OF STUDY (cont.)	PAGE
*Geometry	5. Determine area and circumference of a circle.	88
	9. Determine perimeter and area of polygons.	89
	10. Find the area of an inscribed or a circumscribed polygon or circle.	89
	11. Find the surface area and volume of cylinders, spheres, and prisms, given formulas.	89
	21. Apply properties and theorems related to circles.	89
	23. Find the area of a rectangle or triangle, given the coordinates of the vertices.	90
*Algebra II with Trig.	16. Use perimeter, area, and volume formulas to solve word problems.	95
*Mathematics in Society	13. Apply perimeter, area, and volume formulas in problem solving.	112

**Expansion/Review Material*

SUBJECT	PREREQUISITE SKILLS OR RELATED SKILLS FOR THIS OBJECTIVE WITHIN THE COURSE OF STUDY	PAGE
5th Grade Math	22. Estimate and calculate perimeter and area.	45
	29. Identify and draw parts of a circle.	45
6th Grade Math	24. Estimate perimeters and areas.	51
	25. Calculate areas and perimeters in meaningful context.	51
	29. Exhibit proficiency in drawing and labeling parts of a circle.	51
	30. Establish formulas for determining perimeter, area, volume, and circumference through a variety of explorations.	51
7th Grade Math	5. Perform basic operations on rational numbers.	55
	9. Evaluate powers of whole numbers and roots of perfect squares.	55
	15. Use problem-solving strategies effectively.	56
	24. Determine perimeter, area, and volume by actually measuring using customary and metric units.	57
	37. Demonstrate proficiency in the use of the order of operations.	58
	42. Use vocabulary associated with algebra.	59
	43. Simplify and evaluate linear algebraic expressions.	59
	45. Solve equations and inequalities by substituting values from a given set (domain).	59

SUBJECT	PREREQUISITE SKILLS OR RELATED SKILLS FOR THIS OBJECTIVE WITHIN THE COURSE OF STUDY (cont.)	PAGE
8th Grade Math	1. Demonstrate proficiency in performing basic operations on rational numbers.	62
	3. Demonstrate proficiency in evaluating rational number expressions using the order of operations.	62
	6. Apply the laws of exponents to simplify expressions containing integral exponents.	62
	7. Find square roots of rational numbers.	62
	11. Use problem-solving strategies effectively.	63
	15. Identify the relationships between two- and three-dimensional geometric figures.	63
	28. Identify components of the Cartesian plane.	65
	33. Develop an understanding of algebraic terms.	66
	34. Simplify and evaluate linear algebraic expressions.	67
	36. Solve linear equations and inequalities.	67
	39. Use the properties of rational numbers.	67
Introduction to Algebra	2. Demonstrate proficiency with operations on integers and rational numbers.	74
	4. Recognize, simplify, and use irrational numbers.	74
	9. Demonstrate proficiency in simplifying rational number expressions using the order of operations.	74
	12. Apply the laws of exponents to simplify expressions containing natural number exponents.	75
	14. Use problem-solving strategies effectively.	75
	15. Apply properties of plane and solid geometric figures to solve problems.	75
	18. Deduce lengths of the sides of polygons from given assumptions.	76
Algebra I	4. Use the order of operations, including exponentiation, to simplify numeric and variable expressions.	80
	5. Perform operations involving square roots with and without calculators.	80
	6. Apply the number properties.	80
	20. Perform basic operations on algebraic expressions.	82
	21. Evaluate algebraic expressions.	82
	22. Know and use laws of exponents including zero and negative exponents.	82
	26. Solve linear equations.	83
	28. Solve literal equations for any variable.	83

SUBJECT	PREREQUISITE SKILLS OR RELATED SKILLS FOR THIS OBJECTIVE WITHIN THE COURSE OF STUDY (cont.)	PAGE
*Geometry	20. Describe and identify parts of circles. 31. Solve an equation involving radicals.	89 90
*Mathematics in Society	9. Recognize equivalent representations of the same number.	111
*Algebra II with Trig.	2. Perform operations on rational variable expressions. 29. Solve word problems that involve linear or quadratic equations. 37. Simplify expressions involving rational and irrational exponents. 59. Solve problems using a variety of methods. 60. Identify the results of algorithms.	94 97 98 100 100
*Advanced Mathematics	48. Determine the area of oblique triangles.	107

**Expansion/Review Material*

TEACHER OVERVIEW

Students will be expected to evaluate equations by substituting into formulas that will be given for geometric figures. Formulas, such as the following, could be included.

Perimeter: Squares, Rectangles, and Parallelograms
Circumference: Circles
Area: Squares, Rectangles, Parallelograms, Trapezoids, Triangles, and Circles
(Determining the area of a circle when given the diameter in the drawing may be required.)
Volume: Rectangular Solid
Surface Area: Rectangular Solid

Other formulas and figures could also be used. In this section, formulas will be given with each problem. Drawings and sentences will be used to give information related to the problems. Extraneous information may also be given. Students might be asked to solve the equation for a particular variable as indicated in the activity. This objective could be referred to as a "PLUG AND CHUG" objective because substitution and evaluation are the basic requirements.

The middle-school experience with geometric formulas is crucial. Students must know the parts of each figure and the variable in the formula that represents that part. Students can then substitute the correct numerical value for each variable and evaluate the equation.

Vocabulary: perimeter, area, circumference, diameter, radius, π, volume, surface area, length, width, height, dimensions

ACTIVITY: Geometric Formula Function Machines

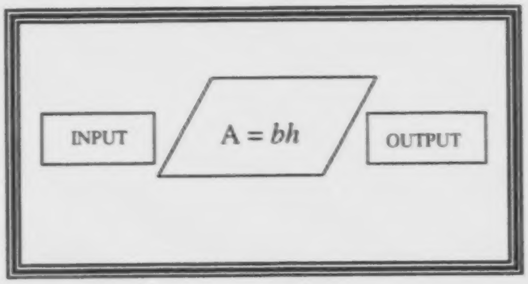
***Purpose*:** To evaluate geometric formulas
To solve geometric formulas (equations) for a specific variable

Materials/Equipment:

Geometric function machines
Master for function machines
Tagboard or letter-size folders
Trifold project board
Input cards
Library card pockets
Output cards (teacher only)

Procedure:

1. Make a classroom-size geometric function machine using a trifold project board and make several individual function machines using tagboard. Make enough individual function machines for each student to have one at all times.
2. To make individual function machines, begin by turning a piece of tagboard lengthwise. Place the geometric shape with the formula in the center of the tagboard. Write INPUT on a library card pocket and place the pocket on the left side of the tagboard. Write OUTPUT on a library card pocket and place the pocket on the right side of the tagboard. Fill the INPUT pocket with numbered index cards. On each index card, write a problem (include word problems and drawings) and the formula required to find the solution. Students will solve each problem by substituting given values into the formula to determine the solution. In the OUTPUT pocket, place strips of paper or index cards. Have students write the answers to the problems on the input cards. Students should number the OUTPUT cards to correspond with the INPUT cards so solutions can be easily verified.



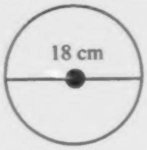
NOTE: This could easily be adapted to a letter-sized folder. Laminating tagboard or folders would make them last for several years.

Sample cards:

a. What is the perimeter of a rectangular area if the width is 20 feet and the length is 35 feet? *(Answer: 110 feet)*
b. The perimeter of a square is 40 inches. What is the length of each side? *(Answer: 10 inches)*
c. The area of a parallelogram is 120 square cm. If the base is 15 cm, what is the height of the figure? *(Answer: 8 cm)*

d. A triangle has a base of 21 and a height of 19. What is the area? *(Answer: 199.5 square units)*

e. Find the area of the circle below. *(Answer:* $81\pi\ cm^2$ *or* $254.34\ cm^2$*)*



f. The area of a square is 36 square inches. Find the length of a side of the square. *(Answer: 6 inches)*

3. The classroom size geometric function board could be designed similar to the individual-sized model. Place Velcro in the center of the classroom-size board. Enlarge the geometric shapes and their formulas and place Velcro on the back of each shape. The teacher can interchange formulas for teaching and reviewing the content of this activity with students. Solution cards for the OUTPUT can be made, and students can match the INPUT and OUTPUT from the larger cards.
4. Allow students to work individually to solve the problems and produce an OUTPUT for each problem with the function machine they received.
5. Rotate the function machines around the room until all students have completed all problems for all of the various formulas.
6. Utilize the classroom-size sets of all geometric function machines to explain the solutions. Have groups come to the front of the classroom and demonstrate how they derived the OUTPUTS for each INPUT value for each machine.
7. Follow this activity with paper-and-pencil experiences of evaluating equations by utilizing the formulas on the geometric function machines.
8. Assign individual problems for students to work.

***Questions*:**

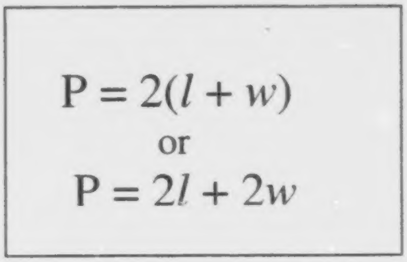
1. What problems were encountered while working with the function machines?
2. What does it mean to solve a literal equation?
3. Why is evaluating formulas the same as evaluating equations? What do both have in common?

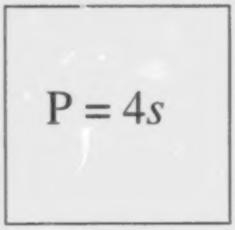
Reading/Writing Connection:

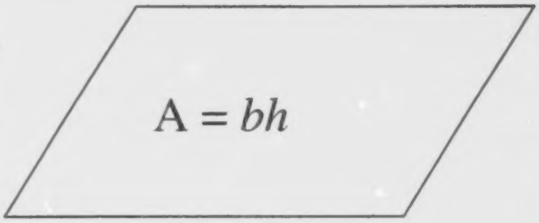
Reading Comprehension Standard II, Objective 3: Determine cause and effect.

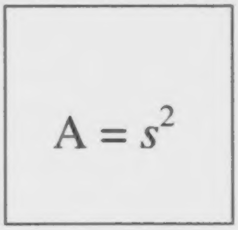
Write a paragraph explaining in detail how to find the input if the output of a function is given.

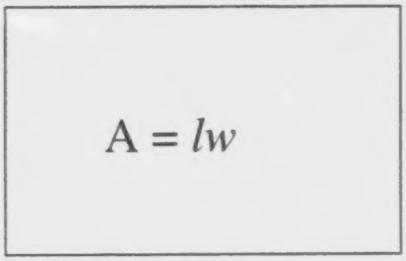
Masters for Function Machine

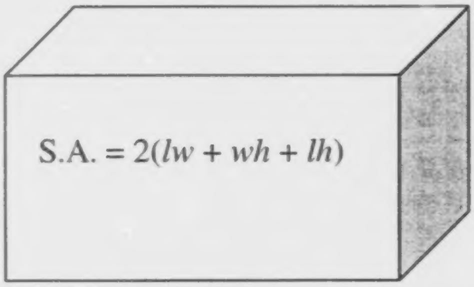

$P = 2(l + w)$
or
$P = 2l + 2w$

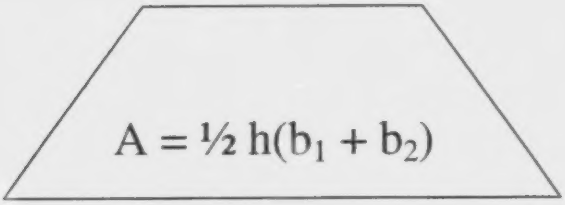


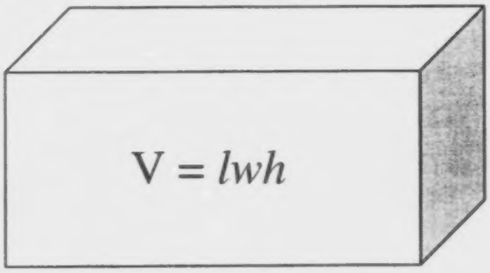


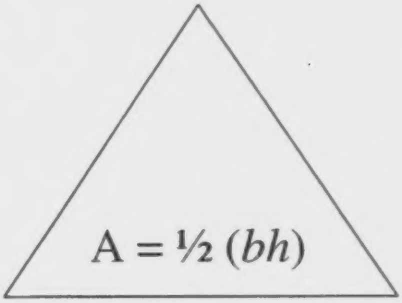


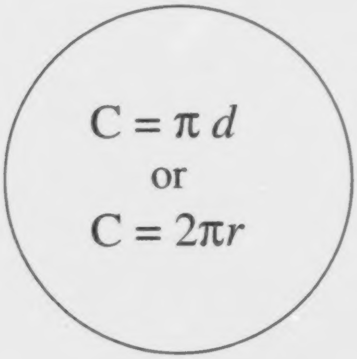


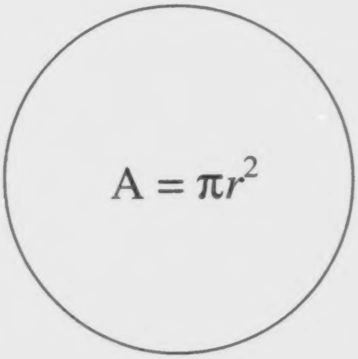



$A = \frac{1}{2} h(b_1 + b_2)$






$C = \pi d$
or
$C = 2\pi r$



STANDARD IV: The student will be able to apply formulas.

OBJECTIVE 2: Find the distance, midpoint, or slope of line segments when given two points.

ELIGIBLE CONTENT:
- Radicals may be used.
- Radicals will be simplified.
- Lines graphed on the coordinate plane may be included.
- Determining the slope of a line given a line on the coordinate plane with two points labeled with their ordered pairs may be required.
- Determining the slope of a line or midpoint of a line segment given two points on a line on the coordinate plane without any coordinates labeled may be required.
- The formulas will be given in the problems.

NUMBER OF TEST ITEMS: 4

SUBJECT	LOCATION OF OBJECTIVE WITHIN THE COURSE OF STUDY	PAGE
7th Grade Math	32. Explore vertical and horizontal distances and slope on the Cartesian plane. 34. Use computers and graphing calculators to facilitate understanding of coordinate geometry and other mathematical concepts.	58 58
8th Grade Math	30. Use computers and graphing calculators to facilitate understanding of coordinate geometry.	66
Introduction to Algebra	21. Determine midpoints and lengths of line segments given coordinates in the Cartesian plane. 26. Determine slopes and y-intercepts of lines.	76 76
Algebra I	11. Apply length, midpoint, and slope of a line segment when given coordinates on a Cartesian plane.	81
*Geometry	24. Determine the slope of a line from its graph or from its equation. 25. Apply formulas of coordinate geometry.	90 90
*Algebra II with Trig.	13. Apply the distance and midpoint formulas to coordinate geometry.	95
*Advanced Mathematics	18. Determine the slope of a polynomial function at a point.	105

**Expansion/Review Material*

SUBJECT	PREREQUISITE SKILLS OR RELATED SKILLS FOR THIS OBJECTIVE WITHIN THE COURSE OF STUDY	PAGE
5th Grade Math	11. Identify alternative representations of fractions, mixed numbers, decimals, and percents. 36. Identify coordinates on grids, graphs, and maps.	43 46
6th Grade Math	36. Identify and plot coordinates on grids, graphs, and maps. 42. Demonstrate an understanding of exponential notation.	52 53
7th Grade Math	5. Perform basic operations on rational numbers. 9. Evaluate powers of whole numbers and roots of perfect squares. 18. Identify equivalent fractions including lowest-term fractions and improper fractions. 31. Draw geometric figures on the Cartesian plane and identify coordinates of vertices. 33. Explore geometric transformations on the Cartesian plane.	55 55 56 58 58
8th Grade Math	1. Demonstrate proficiency in performing basic operations on rational numbers. 6. Apply the laws of exponents to simplify expressions containing integral exponents. 7. Find square roots of rational numbers. 28. Identify components of the Cartesian plane. 29. Explore geometric transformations on the Cartesian plane. 31. Identify and graph functions on the Cartesian plane.	62 62 62 65 66 66
Introduction to Algebra	2. Demonstrate proficiency with operations on integers and rational numbers. 12. Apply the laws of exponents to simplify expressions containing natural number exponents. 22. Identify coordinates of translations, rotations, and reflections. 23. Graph linear functions in the form $y = mx + b$ on the Cartesian plane.	74 75 76 76
Algebra I	5. Perform operations involving square roots with and without calculators. 13. Apply the terminology associated with the Cartesian plane to the graphing of equations. 17. Graph lines given two points or a slope and a point. 18. Graph linear equations written in standard form or slope-intercept form.	80 81 82 82

SUBJECT	PREREQUISITE SKILLS OR RELATED SKILLS FOR THIS OBJECTIVE WITHIN THE COURSE OF STUDY (cont.)	PAGE
***Geometry**	8. Demonstrate reflections, translations, and rotations.	88
	23. Find the area of a rectangle or triangle, given the coordinates of the vertices.	90
	26. Determine an equation of a line from given information.	90
	27. Recognize and use the relationship of the slopes of parallel lines and the slopes of perpendicular lines.	90
***Algebra II with Trig.**	14. Determine an equation of a line given certain conditions.	95
	15. Identify the coordinates of transformations.	95
	18. Analyze the effects of parameter changes on the graphs of functions.	96
	61. Identify equations of lines of regression for a scattergram.	100
***Mathematics in Society**	16. Demonstrate an understanding of the role of geometry in society.	112

**Expansion/Review Material*

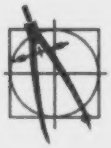
TEACHER OVERVIEW

Students can be introduced to the ideas of slope, midpoint, and distance in a subtle way while studying the coordinate plane. Simple interpretations can lead students to thinking algebraically. Algebra I students will use their concrete experiences in the middle school to develop more abstract concepts. The activities that follow will help students to understand more thoroughly the topics in their high school studies that are related to the coordinate plane. When introducing these topics to middle school students, it is not necessary for them to memorize the formulas used to determine the slope of a line. An exploration of slope, midpoint, and distance will provide a strong background for later studies. The use of a graphing calculator facilitates the exploration of these topics. *(Remember, however, that graphing calculators will not be used on the Alabama High School Graduation Exam.)*

Like Standard IV, Objective 1, this objective is another "PLUG AND CHUG" objective. Substitution and evaluation are the basic requirements. Formulas will be given in each problem.

Vocabulary: coordinate plane, x-axis, y-axis, origin, slope, midpoint, distance, square root, quadrants, horizontal, vertical, ordered pairs

ACTIVITY: Coordinate Classroom



Purpose: To begin a formal study of the coordinate plane and the concepts of distance, slope, and midpoint

Materials/Equipment:

Desks or chairs	Geoboards and rubber bands
Dot paper	Coordinate grid paper
Crepe paper (two different colors)	

Procedure:

1. Prior to class, place the crepe paper on the floor and around or through the chair or desk backs to form the two axes of the coordinate plane. Use a different color for each axis. This will help the students to remember more readily the axis name.
2. Review with students the names and directions of the axes (x-axis is horizontal; y-axis is vertical). Also remind students that the ordered pair indicates a position. The x-value is written first and the y-value is written second.
3. Tell the students to determine their location in relation to the x-axis and the y-axis placed in the classroom. Have each student determine and tell his/her position in the classroom.
4. Introduce the concept of slope to students and call out two points that are occupied by students. (At first use points in the same quadrant, especially if the activity will be modeled using a geoboard.) Establish directions of north, east, south, and west and have students describe how to move from one student to the other. Have students do several examples.
5. Tell students to use their geoboards and three rubber bands to show exactly the process followed by these two students. Use one rubber band to stretch between the two "points" in the room. Use the second rubber band to show the vertical movement (north/south). Use the third rubber band to show the horizontal movement (east/west).
6. Lead the students to discover that the slant between the two points can be described and written as a ratio by using the directions from one point to the other. Students must understand that the vertical direction is always used first and is written as the numerator of the ratio. The horizontal direction is written as the denominator. This forms a ratio known as slope, so that slope = $m = \frac{y_2 - y_1}{x_2 - x_1}$ for two points (x_1, y_1) and (x_2, y_2).
7. Dot paper should be used to explore the idea of the midpoint between two points. Students should plot two points on the coordinate plane. Have students fold their papers so one point lies directly on top of the other point.
8. Have students name the point at which the fold intersects the line. Discuss with students the concept of the midpoint of a line. Ask them to tell what it means to find the middle. Each time record in a table the x-coordinate and the y-coordinate of the two points. Then, record the x-coordinate and the y-coordinate of the midpoint.

9. Introduce the midpoint: Midpoint = $\left(\frac{x_1 + x_2}{2}, \frac{y_1 + y_2}{2}\right)$. Use points graphed by the students to practice using the formula for determining the midpoint. Some example problems are given below for additional practice.

Examples: Find the midpoint and slope for each of the following pairs of problems.

1. A(1, 2), B(3, 4)	*[Answer: (2, 3), m = 1]*
2. C(-5, -8), D (0, 2)	*[Answer: (-5/2, -3), m = 2]*
3. E(-7, -3), F (-5, -1)	*[Answer: (-6, -2), m = 1]*

(NOTE: An extension to this activity can be found under Standard V, Objective 1.)

***Questions*:**

1. What does it mean to have a slope of $\frac{5}{0}$? Why is this called an undefined slope?
   (Answer: x is constant, so this is a vertical line; division by zero is undefined.)
2. How can a horizontal line be represented algebraically on the coordinate plane?
   (Answer: y = constant)
3. How can a vertical line be represented on the coordinate plane algebraically?
   (Answer: x = constant)
4. How is using the coordinate plane related to latitude and longitude on a globe or map?

Reading /Writing Connection:

Reading Comprehension Standard I, Objective 1: Identify supporting details.
Reading Comprehension Standard II, Objective 2: Draw conclusions.

Use the information in the table and the classroom experiences to write how the midpoint of a line can be found when given two points on the coordinate plane. What measure of central tendency is found using the same method? Use several points from the class activity to verify the conclusion.

ACTIVITY: Distance and Pythagoras - What A Slant!

***Purpose*:** To show the relationship between the Pythagorean Theorem and the distance formula

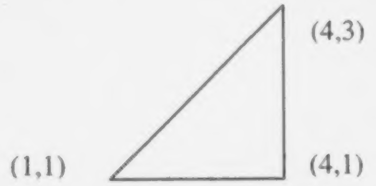
***Materials/Equipment*:**

Coordinate grid transparency or coordinate graph board
Desks or chairs
Crepe paper (two different colors)
Geoboards and rubber bands
Dot paper
Coordinate grid paper

(NOTE: For some students, it would be beneficial to repeat the middle school activities to introduce the topics of slope and midpoint presented in Standard IV, Objective 2. However, Algebra I students should be expected to progress quickly toward the abstract methods of computing slope and midpoint. The midpoint could be related to finding the average of the two x-coordinates and the average of the two y-coordinates.)

***Procedure*:**

1. Tell students to use a geoboard to construct a right triangle with the vertices at (1,1), (4, 1), and (4, 3).



2. Have students identify the legs and the hypotenuse of the triangle. Based on prior of the Pythagorean Theorem, the students should be able to find the hypotenuse. (They will determine the length to be the square root of 13.)
3. Write the following expression on the board and ask students to evaluate it:
   The square root of $(3^2 + 2^2)$
   If students compute correctly, the value of the expression will be the square root of 13. ($\sqrt{3^2+2^2} = \sqrt{9+4} = \sqrt{13}$)
4. Write the distance formula on the board. [$d = \sqrt{(x_2-x_1)^2+(y_2-y_1)^2}$] Identify the coordinates of the points forming the hypotenuse. Substitute the given numerical values and ask the students to evaluate the formula. Again, students should find the solution to be the square root of 13.
5. Label each of the three problems: Label the problem in Step 2: Pythagorean Theorem. Label the problem in Step 3: algebraic expression. Label the problem in Step 4: distance formula. Ask students to explain how the first problem and the last problem are related to each other.
6. Formally introduce students to the distance formula using various polygons drawn on the coordinate grid.
7. Provide students with opportunities to use this concept for determining perimeter, area, or circumference. This allows students to experience how algebraic topics and geometric topics are interrelated.
8. For pure "plug and chug" problems, use the ordered pairs under the "Coordinate Classroom" activity and find the distance between the two points given in each problem.
   (Answers: $2\sqrt{2}$, $5\sqrt{5}$, $2\sqrt{2}$)

***Questions*:**

1. Draw the right triangle in quadrant III. Does this change the formula for determining the distance? *(Answer: No.)*
2. Is the slope of the hypotenuse of a right triangle graphed on the coordinate plane always the same? Why or why not? *(Answer: No. The values and signs of the slope will differ based on the coordinates of the points given.)*

Reading/Writing Connection:

Reading Comprehension Standard I, Objective 2: Determine sequence of events.
Reading Comprehension Standard II, Objective 5: Recognize statements that adequately summarize a passage.
Reading Comprehension Standard IV, Objective 4: Demonstrate the ability to locate information in reference material.

Research how slope has been used to provide access for the handicapped in America. What is the recommended slope for a ramp that is to be used by handicapped individuals? How does all of this relate to the distance formula?

What other situations are represented by the slope of a line? (pitch of a roof, grade of a road, stairs meeting building code standards, planes departing and landing, etc.).

STANDARD V: **The student will be able to apply graphing techniques.**

OBJECTIVE 1: **Graph or identify graphs of linear equations.**

ELIGIBLE CONTENT:
- **Equations may be expressed in terms of *f*(x).**
- **The options may be four graphs.**
- **The options may be four equations.**

NUMBER OF TEST ITEMS: Objectives 1 and 4 contain a total of 6 questions.

SUBJECT	LOCATION OF OBJECTIVE WITHIN THE COURSE OF STUDY	PAGE
8th Grade Math	31. Identify and graph functions on the Cartesian plane.	66
Introduction to Algebra	23. Graph linear functions in the form y = mx + b on the Cartesian plane.	76
Algebra I	18. Graph linear equations written in standard form or slope-intercept form.	82

SUBJECT	PREREQUISITE SKILLS OR RELATED SKILLS FOR THIS OBJECTIVE WITHIN THE COURSE OF STUDY	PAGE
5th Grade Math	36. Identify coordinates on grids, graphs, and maps.	46
6th Grade Math	36. Identify and plot coordinates on grids, graphs, and maps.	52
7th Grade Math	31. Draw geometric figures on the Cartesian plane and identify coordinates of vertices.	58
	32. Explore vertical and horizontal distances and slope on the Cartesian plane.	58
	34. Use computers and graphing calculators to facilitate understanding of coordinate geometry and other mathematical concepts.	58
8th Grade Math	28. Identify components of the Cartesian plane.	65
	30. Use computers and graphing calculators to facilitate understanding of coordinate geometry.	66

SUBJECT	PREREQUISITE SKILLS OR RELATED SKILLS FOR THIS OBJECTIVE WITHIN THE COURSE OF STUDY (cont.)	PAGE
Introduction to Algebra	20. Demonstrate proficiency in using vocabulary and basic concepts related to the coordinate plane.	76
Algebra I	13. Apply the terminology associated with the Cartesian plane to the graphing of equations.	81
	17. Graph lines given two points or a slope and a point.	82
	19. Graph systems of linear equations.	82
***Algebra II with Trig.**	17. Graph basic equations and identify the graphs of basic equations in the coordinate plane.	95

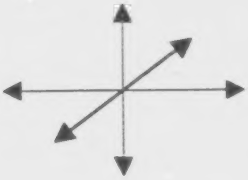
**Expansion/Review Material*

TEACHER OVERVIEW

The student will need to recognize a given equation's graph and will also need to recognize an equation given a certain graph. To do this, the student should graph a line using more than one method. For a quick review, students can use a graphing calculator to demonstrate graphs of equations. *However, graphing calculators will not be allowed on the graduation examination.*

ACTIVITY: Coordinate Classroom

(Reference the activity from Standard IV, Objective 2.)



Purpose: To graph a line on a coordinate plane

Materials/Equipment:

Desks or chairs
Coordinate grid paper (graph paper)
Crepe paper (three different colors)

Procedure:

As a continuation of the coordinate room activity, have groups of students "graph" a line.

1. Given an equation, have a student stand on the x-intercept and a second student stand on the y-intercept. The two students will stretch crepe paper between them to represent the line. (Give the students the x-intercept and the y-intercept to begin. Then give them an equation

and have them determine the intercepts.) After several examples, have the students graph the examples on the coordinate grid paper.

2. Give an equation in slope-intercept form (y = mx + b). Have one student begin on the y-intercept and have another student "move" the slope to a second point. (Remember, slope can be defined as "rise over run.") Have a third student begin at the y-intercept and "move" the slope in the opposite direction and show that all of them are still on the same line. Explain that another representation for the slope-intercept form y = mx + b is *f*(x) = mx + b. Develop student understanding that y and *f*(x) represent the value of y for a given value of x. The equation may be written in either format.

3. Graph a vertical line and a horizontal line using at least five students for each. Draw several graphs of vertical lines and several graphs of horizontal lines. Help students recognize that the graph of any vertical line will be represented by an equation in the form x = c and that horizontal lines will be represented by an equation in the form y = c.

4. Proceed from this activity into examples of the type specified in the eligible content. After discussing the examples, assign problems for students to work on their own. These problems should specifically target skills involved in graphing linear equations.

    - Give the students an equation in slope-intercept form (y = mx + b) to graph.
    - Give the students an equation in standard form (ax + by = c) to graph.
    - Give students the graph of a line. Ask them to write the equation of that line.
    - Give students four graphs of equations of lines and one equation that is illustrated in one of the graphs. Ask them to match the equation to the correct graph.

Questions:

1. Explain how the second and third student can move in opposite directions in the activity above and still be on the same line. *[Answer: Each student is moving in a positive or negative direction. For example, a positive slope can "rise up" (+) and "run right" (+) or* ($\frac{+}{+}$)*. A positive slope can also "rise down" (–) and "run left" (–) or* ($\frac{-}{-}$)*.]*
2. Why is the equation of a horizontal line y = c and the equation of a vertical line x = c ? *(Answer: A horizontal line is y = c because all of the y values are constant. Y is the same for any value of x. A vertical line is x = c because all of the x values are constant. X is the same for any value of y.)*
3. What is the slope of a vertical line? *(Answer: undefined or "no slope")* What is the slope of a horizontal line? *(Answer: zero)*

Reading/Writing Connection:

Reading Comprehension Standard II, Objective 3: Determine cause and effect.

Write a paragraph explaining the graphs and equations of vertical and horizontal lines. Explain the connection of the graphs to the equations.

STANDARD V: The student will be able to apply graphing techniques.

OBJECTIVE 2: Graph lines given certain conditions.

ELIGIBLE CONTENT:
- The following conditions may be included:
  - two points
  - x- and y-intercepts
  - point and slope
  - slope and y-intercept

NUMBER OF TEST ITEMS: 4

SUBJECT	LOCATION OF OBJECTIVE WITHIN THE COURSE OF STUDY	PAGE
8th Grade Math	31. Identify and graph functions on the Cartesian plane.	66
Introduction to Algebra	23. Graph linear functions in the form y = mx + b on the Cartesian plane.	76
	27. Identify graphs that represent data given in a table.	76
Algebra I	17. Graph lines given 2 points or a slope and a point.	82
	18. Graph linear equations written in standard form or slope-intercept form.	82
	29. Determine equations of lines satisfying given conditions.	83

SUBJECT	PREREQUISITE SKILLS OR RELATED SKILLS FOR THIS OBJECTIVE WITHIN THE COURSE OF STUDY	PAGE
5th Grade Math	36. Identify coordinates on grids, graphs, and maps.	46
6th Grade Math	36. Identify and plot coordinates on grids, graphs, and maps.	52
7th Grade Math	31. Draw geometric figures on the Cartesian plane and identify coordinates of vertices.	58
	32. Explore vertical and horizontal distances and slope on the Cartesian plane.	58
	34. Use computers and graphing calculators to facilitate understanding of coordinate geometry and other mathematical concepts.	58

SUBJECT	PREREQUISITE SKILLS OR RELATED SKILLS FOR THIS OBJECTIVE WITHIN THE COURSE OF STUDY (cont.)	PAGE
8th Grade Math	28. Identify components of the Cartesian plane.	65
Introduction to Algebra	20. Demonstrate proficiency in using vocabulary and basic concepts related to the coordinate plane. 26. Determine slopes and y-intercepts of lines.	76 76
Algebra I	13. Apply the terminology associated with the Cartesian plane to the graphing of equations. 15. Graph and identify graphs of common relations. 19. Graph systems of linear equations.	81 81 82
*Geometry	24. Determine the slope of a line from its graph or from its equation.	90
*Algebra II with Trig.	14. Determine an equation of a line given certain conditions.	95
*Advanced Mathematics	14. Graph parametric equations. 30. Graph piecewise functions.	105 106

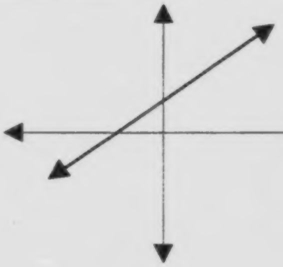
**Expansion/Review Material*

TEACHER OVERVIEW

Students are expected to graph lines given different conditions. Graphing, using a table of points, will not prepare the student for all of these conditions. Therefore, the point-slope method, the slope and y-intercept method, and the intercept method must also be included in classroom presentations.

The following statements have no mathematical relevance, but they may assist students in remembering the slopes of horizontal and vertical lines. These statements would also help students identify the equation of each line given the slope.

> *When the slope and a point are given for a vertical or horizontal line, students may be confused. Remind them that the spelling of vertical has no "zero", so a vertical line has no slope (or the slope of a vertical line is undefined). The spelling of horizontal has a "zero", so the slope of a horizontal line is always zero.*



ACTIVITY: Progressive Graphing

Purpose: To graph a line in slope-intercept (y = mx + b) form

Materials/Equipment:

Index cards with linear equations written on the front (solutions could be on the back of the cards)
Graph paper with axes

Procedure:

1. Organize students in groups of four and assign each student a number.
2. Deal four cards to each group.
3. Student #1 starts (renumber students each time) and solves the equation for y on the first card.
4. Student #2 finds one point for the line and plots it. Student #3 finds a second point, and student #4 finds a third point.
5. The paper goes back to student #1 to graph the line.
6. Continue with the other four cards until students have graphed all equations.

Questions:

1. What happens if "y" is not in the equation? *(Answer: Solve for x. The line is vertical. $x = c$)*
2. What happens if "x" is not in the equation? *(Answer: Solve for y. The line is horizontal. $y = c$)*
3. What happens if the points are not in a line? *(Answer: A calculation error may have been made. All students need to recheck their work.)*

Extension:

The activity could be extended for:

1. x- and y- intercepts by having
    - student #1 arrange the equation in standard form ($ax + by = c$);
    - student #2 find and plot the y-intercept (substitute 0 for the x-value and solve for y);
    - student #3 find and plot the x-intercept (substitute 0 for the y-value and solve for x);
    - student #4 graph the line.
2. point and slope by having
    - student #1 find one point on the line and plot it;
    - student #2 find the slope;
    - student #3 use the slope to plot a second point;
    - student #4 use the slope in the opposite direction to find a third point and graph the line.
3. slope and y-intercept by having
    - student #1 arrange the equation in slope-intercept form ($y = mx + b$);
    - student #2 find and plot the y-intercept;

- student #3 find and use the slope to find a second point;
- student #4 use the slope in the opposite direction to find a third point and graph the line.

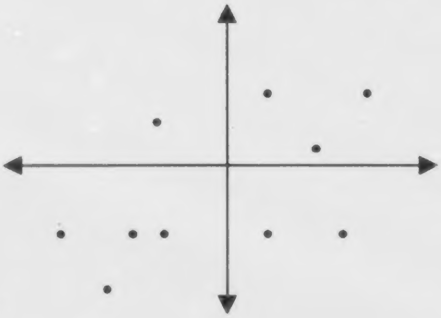
__Reading/Writing Connection__:

Reading Comprehension Standard I, Objective 3: Follow directions.
Reading Comprehension Standard II, Objective 3: Determine cause and effect.

Have the students write an explanation of why points might not be in a line. Have them troubleshoot ways to correct the problem.

ACTIVITY: Line of Best Fit

__Purpose__: To draw a line of best fit, given a set of data
To write an equation of a line



__Materials/Equipment__:

Graph paper
Pencil
Straight edge

__Procedure:__

1. Divide the class into pairs and give each pair a set of data that will graph a "not-so-perfect" line.
2. Have students plot the points.
3. Have students draw a line of best fit.
4. Tell students to find the equation of their line of best fit.

Sample sets of data:
{(1,1), (1,-3), (2,-1), (2,-4), (3,-3), (4,-7), (5,-5), (7,-4)}
{(-2,0), (2,1), (2,5), (4,3), (5,7), (7,4)}
{(-2,1), (-3,4), (-4,2), (-4,5), (-5,1), (-7,5)}

__Questions:__

1. Discuss ways to find the slope from the graph.
2. Compare the different equations and discuss why the lines may be different.

__Reading/Writing Connection__:

Reading Comprehension Standard IV, Objective 3: Discern organizational patterns.
Reading Comprehension Standard II, Objective II: Draw conclusions.

The questions presented in each activity may be given as a writing assignment.

STANDARD V: **The student will be able to apply graphing techniques.**

OBJECTIVE 3: **Determine solution sets of inequalities.**

ELIGIBLE CONTENT:
- **Compound inequality may be included.**
- **Solving inequality may be required.**
- **Options will be graphs.**

NUMBER OF TEST ITEMS: 4

SUBJECT	LOCATION OF OBJECTIVE WITHIN THE COURSE OF STUDY	PAGE
7th Grade Math	45. Solve equations and inequalities by substituting values from a given set (domain). 47. Solve linear inequalities of the type ax + b > c and graph the solution set on a number line.	59 59
8th Grade Math	36. Solve linear equations and inequalities. 37. Use linear equations and inequalities to solve problems.	67 67
Algebra I	3. Graph the solution set of a linear inequality in one variable on the number line. 24. Identify equations or inequalities that represent graphs or problem situations. 30. Solve linear inequalities.	80 82 83
***Algebra II with Trig.**	23. Solve equations or inequalities involving absolute value. 26. Express the solutions of equations or inequalities in different ways. 28. Identify equations or inequalities that represent problem situations. 32. Solve systems of equations or inequalities.	97 97 97 97

**Expansion/Review Material*

SUBJECT	PREREQUISITE SKILLS OR RELATED SKILLS FOR THIS OBJECTIVE WITHIN THE COURSE OF STUDY	PAGE
5th Grade Math	40. Recognize that two equivalent quantities remain equal when the same change takes place on each quantity. 42. Develop an understanding of the order of operations.	47 47
6th Grade Math	51. Recognize vocabulary associated with sets.	54
7th Grade Math	3. Represent rational numbers on the number line. 37. Demonstrate proficiency in the use of the order of operations. 42. Use vocabulary associated with algebra. 48. Exhibit understanding of the properties of rational numbers.	55 58 59 59
8th Grade Math	9. Graph real numbers on a number line. 33. Develop an understanding of algebraic terms. 34. Simplify and evaluate linear algebraic expressions. 39. Use the properties of rational numbers.	62 66 67 67
Introduction to Algebra	3. Apply properties of rational numbers. 34. Determine equations or inequalities that represent problem situations.	74 77
***Advanced Mathematics**	50. Use trigonometric equations and inequalities to solve word problems.	108

**Expansion/Review Material*

TEACHER OVERVIEW

Just as teachers use a balanced scale to aid in the evaluation of equations, an unbalanced scale can be used to solve inequalities. The following activities and hints will allow students to continue the practice of isolating a variable with the added connection of algebra to geometry by graphing points, segments, rays, and lines on the real number line to illustrate the solutions of inequalities. The relationship of simple logic and inductive reasoning to algebra may be shown through graphing the solutions of combined inequalities. Teachers should consider extending this lesson in order to make this connection.

ACTIVITY: Unbalanced Scale

Purpose: To provide an introductory activity for solving linear inequalities

Materials/Equipment:

Algebra tiles (Multi-colored construction paper can be substituted for the tiles.)
Equation mat (Plain white typing paper with the fulcrum drawn on it can be used. Students can draw in the line for balancing depending on the inequality being solved.)

Procedure:

Model the inequality $z - 8 > 8$. (See Figure 1.)

1. Place 1 square and 8 red circles (negative) on the left side of the mat.
2. Place 8 green circles (positive) on the right side of the mat.
3. Ask: "How many circles should be added to the left side to make the numerals equal to zero?" *(Answer: 8)*
4. Ask: "Should these circles be green or red?" *(Answer: Green)*
5. Add 8 green circles to the left side.
6. Ask: "What should be done next to keep the inequality equivalent to the original inequality?" *(Answer: Add 8 green circles to the right side.)*
7. Add 8 green circles to the right side.
8. Ask: "If I group the circles on the left side, what will happen?" *(Answer: You will have 8 red circles and 8 green circles that will form zero pairs.)*
9. Group the circles on the left side.
10. Ask: "What can be done with the zero pairs?" *(Answer: They can be removed because they equal zero.)*
11. Remove the circles on the left side.
12. Ask: "What remains on the left side of the mat?" *(Answer: One square)*
13. Ask: "What does the square represent?" *(Answer: z)*
14. Ask: "What remains on the right side of the mat?" *(Answer: 16 green circles)*
15. Ask: "How would I write this in symbols?" *(Answer: $z > 16$)*
16. Say: "$z - 8 > 8$ is the same as $z > 16$.
    Therefore, the solution of $z - 8 > 8$ is $z > 16$."
17. Have the students graph the solution on the number line.

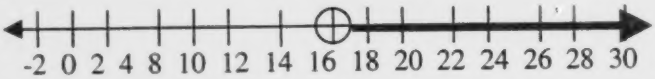


Illustration:* *Unbalanced Scale:

□ = z

○ = + constant
(green)

● = - constant
(red)

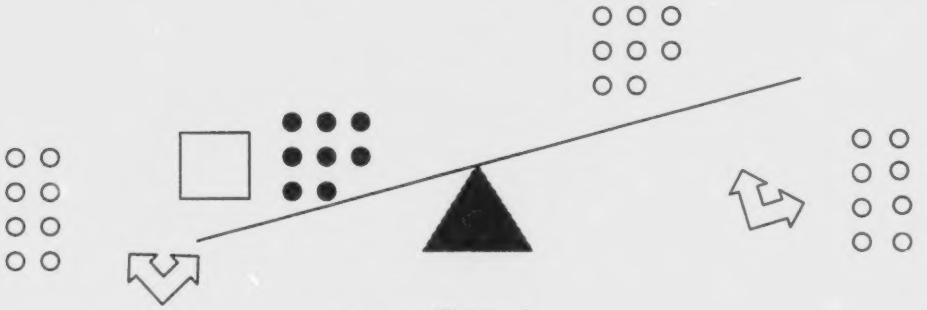
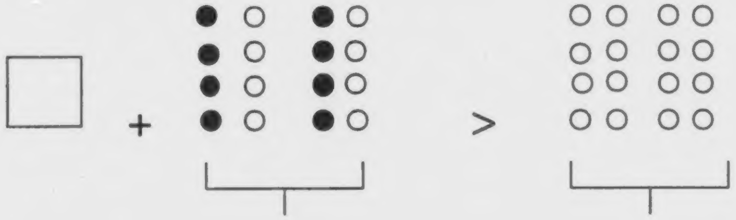


Figure 1



$$z + 0 > 16$$

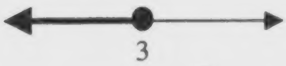
$$z > 16$$

Helpful Hint: When using the number line to represent solutions for combined inequalities, teachers could have students use two different highlighters (markers) to represent shading of compound statements. The resulting blended colors will represent the solution.

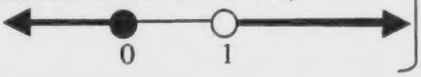
Additional Problems:

Solve the following inequalities and graph the solution.

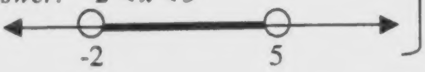
1. $2x \le 6$ *(Answer:* $x \le 3$;



2. $3x > 3$ or $x \le 0$ *Answer:* $x > 1$ *or* $x \le 0$;

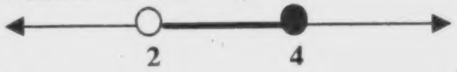


3. $x + 1 < 6$ and $5x > -10$ *Answer:* $-2 < x < 5$



4. $4 < 2x \leq 8$

Answer: $2 < x \leq 4$;



Mini-Activity: Students could be asked to scan periodicals for ads or articles using minimum and maximum values.

Reading/Writing Connection:

Reading Comprehension Standard II, Objective 2: Draw conclusions.

Describe the difference between conjunction and disjunction statements.

STANDARD V: **The student will be able to apply graphing techniques.**

OBJECTIVE 4: **Identify graphs of common relations.**

ELIGIBLE CONTENT:

- **The common relations are:**
  - **x = constant**
  - **y = constant**
  - **y = x**
  - **y =** $\sqrt{x}$
  - **y =** x^2
  - **y =** $|x|$
- **The options may be four graphs.**
- **The options may be four equations.**

NUMBER OF TEST ITEMS: Objectives 1 and 4 contain a total of 6 questions

SUBJECT	LOCATION OF OBJECTIVE WITHIN THE COURSE OF STUDY	PAGE
Algebra I	15. Graph and identify graphs of common relations.	81
***Algebra II with Trig.**	17. Graph basic equations and identify the graphs of basic equations in the coordinate plane.	95

**Expansion/Review Material*

SUBJECT	PREREQUISITE SKILLS OR RELATED SKILLS FOR THIS OBJECTIVE WITHIN THE COURSE OF STUDY	PAGE
8th Grade Math	7. Find square roots of rational numbers.	62
	14. Recognize and use absolute value of real numbers.	63
	30. Use computers and graphing calculators to facilitate understanding of coordinate geometry.	66
	31. Identify and graph functions on the Cartesian plane.	66
Introduction to Algebra	13. Recognize absolute value as distance from zero on the number line.	75
	23. Graph linear functions in the form y = mx + b on the Cartesian plane.	76
Algebra I	5. Perform operations involving square roots with and without calculators.	80
	7. Recognize absolute value of a number as its distance from zero on a number line.	80

SUBJECT	PREREQUISITE SKILLS OR RELATED SKILLS FOR THIS OBJECTIVE WITHIN THE COURSE OF STUDY (cont.)	PAGE
Algebra I (cont.)	40. Identify graphs of functions given data in tables or equations.	84
***Advanced Mathematics**	22. Identify and graph conic sections from second degree equations in any given form. 27. Identify functions from tables of values or graphs.	105 106

**Expansion/Review Material*

TEACHER OVERVIEW

Students should be able to recognize graphs of common relations without hesitation. To build this understanding, help students visualize the graphs and match each graph with its equation. Graphing calculators will not be used on the graduation examination but could be used to help students discover the shape of the graphs of common relations.

ACTIVITY: Graphing Aerobics

Purpose: To recall basic graphs quickly

Materials/Equipment:

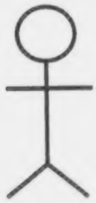
None

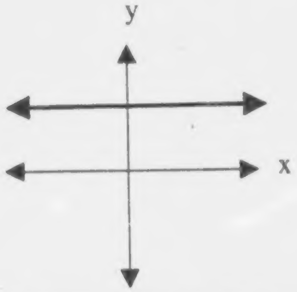
Procedure:

As a warm-up activity or review, let the students demonstrate common graphs using aerobics.

y = constant

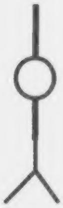
arms outstretched like a horizontal line

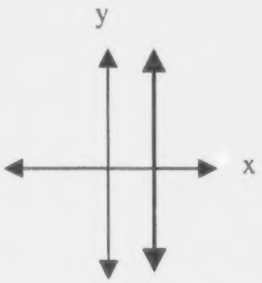




x = constant

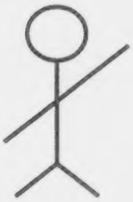
one arm straight up and one arm straight down to look like a vertical line

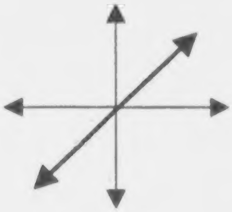




$v = x$

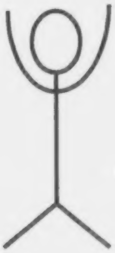
arms stretched to form a diagonal
(You can switch directions to change slope +/-.)

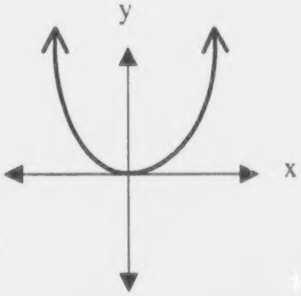




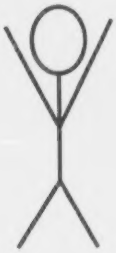
$v = x^2$

arms raised above head in a curve (like "TOUCHDOWN")

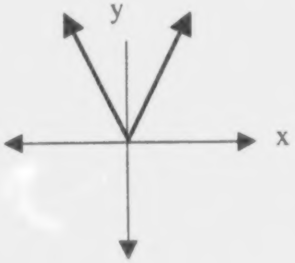




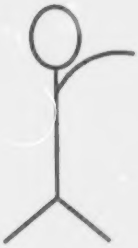
$v = |x|$



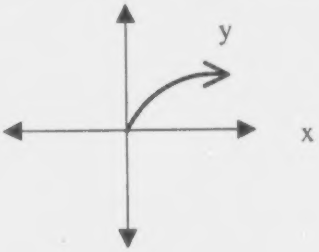
arms raised above head in a "V" (like a cheerleader)



$y = \sqrt{x}$



one arm down and one arm outstretched and curved



Questions:

What happens for $y = -x^2$? For $y = -|x|$? *(Answer: They are reflections of the original graphs across the x-axis.)*

***Reading/Writing Connection*:**

Reading Comprehension Standard II, Objective 2: Draw conclusions.

Write a paragraph to explain the answer to the question above.

STANDARD VI: **The student will be able to represent problem situations.**

OBJECTIVE 1: **Translate verbal or symbolic information into algebraic expressions; or identify equations or inequalities that represent graphs or problem situations.**

ELIGIBLE CONTENT:

- **Determining an equation or expression when given a verbal description may be required.**
- **Graphing inequalities using a number line may be required.**
- **Determining the equation of a line given two ordered pairs may be required.**
- **Determining the equation of a line given the line graphed on the coordinate plane may be required.**

NUMBER OF TEST ITEMS: **6**

SUBJECT	LOCATION OF OBJECTIVE WITHIN THE COURSE OF STUDY	PAGE
7th Grade Math	44. Translate verbal phrases and sentences into symbolic notation. 47. Solve linear inequalities of the type ax + b > c and graph the solution set on a number line.	59 59
8th Grade Math	35. Translate verbal phrases and sentences into symbolic notation.	67
Introduction to Algebra	34. Determine equations or inequalities that represent problem situations.	77
Algebra I	23. Translate verbal or symbolic information into algebraic expressions. 24. Identify equations or inequalities that represent graphs or problem situations. 29. Determine equations of lines satisfying given conditions.	82 82 83
***Geometry**	26. Determine an equation of a line from given information.	90
***Algebra II with Trig.**	14. Determine an equation of a line given certain conditions. 28. Identify equations or inequalities that represent problem situations.	95 97

**Expansion/Review Material*

SUBJECT	PREREQUISITE SKILLS OR RELATED SKILLS FOR THIS OBJECTIVE WITHIN THE COURSE OF STUDY	PAGE
5th Grade Math	36. Identify coordinates on grids, graphs, and maps.	46
6th Grade Math	36. Identify and plot coordinates on grids, graphs, and maps.	52
8th Grade Math	28. Identify components of the Cartesian plane. 31. Identify and graph functions on the Cartesian plane.	65 66
Introduction to Algebra	20. Demonstrate proficiency in using vocabulary and basic concepts related to the coordinate plane. 26. Determine slopes and y-intercepts of lines.	76 76
*** Mathematics in Society**	25. Represent problem situations using discrete structures such as finite graphs, matrices, sequences, and recurrence relations.	113

**Expansion/Review Material*

TEACHER OVERVIEW

Translating word expressions to algebraic expressions is an essential skill in solving word problems. An algebraic expression consists of one or more numbers and variables along with one or more arithmetic operations. This objective encompasses several problem-solving situations. It provides a rare opportunity for teachers to make the connection between real-world situations and algebra. The following strategies are useful for this standard.

- **Identifying Conditions**
- **Organizing Data**
- **Making a Chart**
- **Four-Step Problem-Solving Plan**

ACTIVITY: Math Words Scavenger Hunt

Purpose: To serve as an introductory activity for recognizing math-related words

Materials/Equipment:

Newspapers or magazines	Glue stick
Scissors	Typing paper

Procedure:

1. Place a chart with some math-related words on the board, overhead, or wall.
2. Give each student newspapers/magazines, scissors, a glue stick, note cards, and a list of word problems.
3. Tell the students to do the following:
   a. Locate math-related words in their newspapers/magazines.
   b. Tell them to try to find more math-related words than appear on the chart.
   c. Cut out each word of the newspaper.
   d. Paste each word on a separate note card.
   e. Write the operation that the word represents on the note card with the word.
   f. Use the note cards to decide the appropriate operations to use to solve the word problems given.
4. Check the students' note cards.
5. Tell the students to do the following:
   a. Read each word problem and determine what operation would be needed to solve the problem.
   b. Write the operation beside the word problem.
6. Check each student paper.
7. Tell the students to do the following:
   a. Translate each word problem into an algebraic expression or equation.
   b. Write the algebraic expression or equation beside the word problem.
8. Check the papers of all students.

ADD (+)	SUBTRACT (–)	MULTIPLY (x)	DIVIDE (÷)
plus	**Minus**	**times**	**quotient**
increase	**Less**	**twice**	**ratio**
more than	**less than**	**triple**	**part of**
increased by	**decreased by**	**percent**	**shared equally**
total	**subtracted from**	**of**	**divided by**
added to	**Difference**	**multiplied by**	
sum		**product**	
altogether		**squared**	
		cubed	

Use these key words for problem-solving situations.

Reading/Writing Connection:

Reading Comprehension Standard IV, Objective 1: Determine word meaning through the use of context clues.

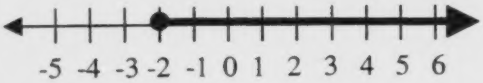
Does the order in which algebraic terms are written make a difference? Write a paragraph to explain why or why not.

Try this:

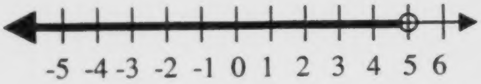
The surface area of a rectangular prism is the sum of the product of twice the length *l* and the width w and the product of twice the length and the height *h* and the product of twice the width and the height. Write an expression that represents the surface area of this type of prism. *[Answer:* $S = 2lw + 2lh + 2wh$ *or* $S = 2(lw + lh + wh)$*]*

Additional Problems:

1. Graph: $n \geq -2$ *Answer:*

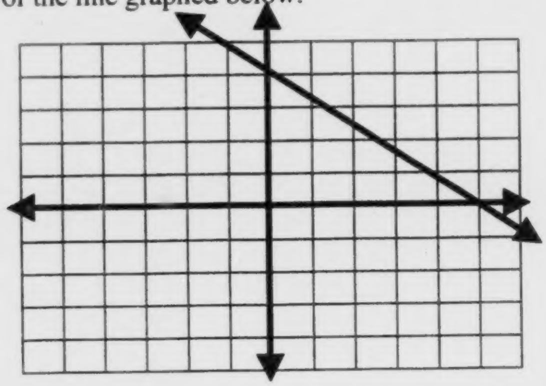


2. Solve and graph:
$3n + (-4) < 11$ *Answer:*
$3n < 15$
$n < 5$



3. Find the equation of the line given the ordered pairs: (−7,2) , (5,6).
(Answer: $x - 3y = -13$*)*

4. Find the equation of the line graphed below.



(Answer: $y = \frac{-4}{5}x + 4$ *)*

5. Find the equation of a line whose slope is 1 if it passes through the point (4, 9).
(Answer: $x - y = -5$*)*

STANDARD VII: The student will be able to solve problems involving a variety of algebraic and geometric concepts.

OBJECTIVE 1: Apply properties of angles and relationships between angles.

ELIGIBLE CONTENT:

- The following properties and relationships may be included:
  - vertical angles
  - adjacent angles
  - supplementary angles
  - complementary angles
  - linear pair (adjacent supplementary angles)
  - Relationships among the measures of angles formed by two parallel lines and a transversal
- Word problems may be used.
- The knowledge of the sum of measures of angles may be used.
- Determining measurements of angles when the measurements of angles are expressed as algebraic expressions may be required.

NUMBER OF TEST ITEMS: 4

SUBJECT	LOCATION OF OBJECTIVE WITHIN THE COURSE OF STUDY	PAGE
7th Grade Math	30. Describe relationships between pairs of angles.	58
8th Grade Math	20. Demonstrate proficiency in classifying angles according to their characteristics.	64
	22. Recognize the relationship of angles formed by two parallel lines cut by a transversal.	64
	24. Solve problems using relationships between angles.	65
*Geometry	4. Measure and classify angles.	88
	12. Apply postulates and theorems related to parallel lines.	89
	14. Describe and use relationships between pairs of angles.	89
	18. Deduce the measure of angles associated with polygons from given information.	89

***Expansion/Review Material**

SUBJECT	PREREQUISITE SKILLS OR RELATED SKILLS FOR THIS OBJECTIVE WITHIN THE COURSE OF STUDY	PAGE
5th Grade Math	23. Classify, compare, measure, and draw angles. 26. Define and/or draw plane geometric representations. 28. Exhibit proficiency in identifying parallel lines, perpendicular lines, squares, circles, rectangles, triangles, cubes, rectangular prisms, cones, cylinders, and pyramids.	45 45 45
6th Grade Math	32. Classify and measure angles. 33. Develop understanding of geometric figures by drawing with a straightedge and/or a protractor. 35. Describe relationships between pairs of angles.	51 51 52
7th Grade Math	28. Exhibit proficiency in identifying relationships between pairs of lines.	57
8th Grade Math	21. Estimate measures of angles and verify results.	64
Introduction to Algebra	17. Deduce measures of angles in polygons from given assumptions.	76
***Geometry**	16. Apply properties and measures associated with triangles and quadrilaterals to solve problems.	89
***Mathematics in Society**	14. Use symmetry, perspective, spatial representation, or patterns to evaluate and or create works of art. 16. Demonstrate an understanding of the role of geometry in society.	112 112

**Expansion/Review Material*

TEACHER OVERVIEW

Instruction should address vocabulary, properties of angles, and relationships between angles. Teachers should emphasize the use of algebraic expressions to represent angle measures. Students will be required to combine algebra skills with knowledge of angles to solve problems related to this standard. Activities can be created to assist in the review and application of these concepts. A few sample activities are shown on page C-102 to provide teachers a starting point in helping their students understand this objective. After each activity, students should be provided with specific content problems related to this objective.

Sample Problems:

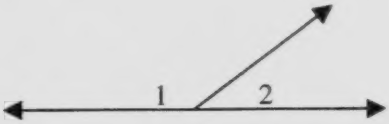
1. Find the complement of a 67° angle. *(Answer:* $90° - 67° = 23°$ *)*

2. The measure of an angle is three times the measure of its supplement. Find the measure of this angle.

Solution: Let x = *the measure of the angle and*
$180 - x$ = *the measure of the angle's supplement.*
Then:

$$\begin{aligned} x &= 3(180 - x) \\ x &= 540 - 3x \\ 4x &= 540 \\ x &= 135, \text{ so the angle measures } 135° \end{aligned}$$

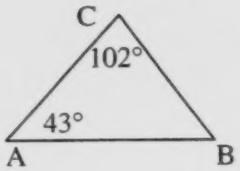
3. In the figure shown, find the value of x if $m\angle 1 = (3x - 13)$ and $m\angle 2 = (2x + 8)$. Find the measure of $\angle 1$.



Solution: *Because* $\angle 1$ *and* $\angle 2$ *are linear pair angles, they are supplementary. This fact can be used to set up an algebraic equation.*

$$\begin{aligned} m\angle 1 + m\angle 2 &= 180 \\ (3x - 13) + (2x + 8) &= 180 \\ 5x - 5 &= 180 \\ 5x &= 185 \\ x &= 37, \text{ so } m\angle 1 = 3(37) - 13 \\ m\angle 1 &= 98 \\ \angle 1 &= 98° \end{aligned}$$

4. In ΔABC, $m\angle A = 43$ and $m\angle C = 102$. Find $m\angle B$.



Solution:

$$\begin{aligned} m\angle B &= 180 - (43 + 102) \\ &= 180 - 145 \\ m\angle B &= 35 \end{aligned}$$

Angle B measures 35°

Vocabulary: acute angle, obtuse angle, right angle, vertical angles, adjacent angles, supplementary angles, complementary angles, linear pair angles, parallel lines, transversal, perpendicular lines

ACTIVITY: Angle Measuring Activity

Purpose: To give students an opportunity to review types of angles and discover important relationships between some types of angles and angle pairs

Materials/Equipment:

Protractors
Copies of the "Angle Discovery Sheet" (See page C-104.)
Textbooks and/or math dictionaries for students to define types of angles

Procedure:

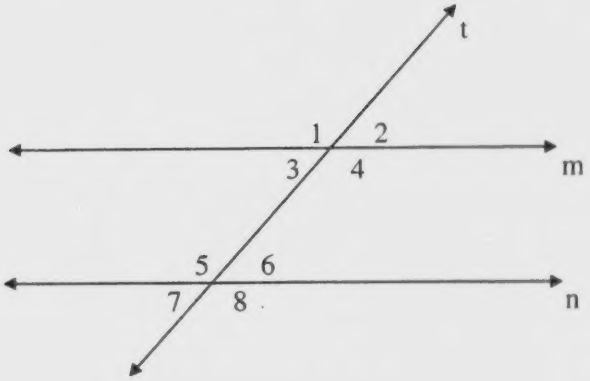
1. Divide students into pairs or groups of three.
2. Hand out a copy of the "Angle Discovery Sheet" to each student.
3. Give each student a protractor to use in measuring angles.
4. Tell students to measure each angle. Give them ample time to complete this task. Tell students to come to an agreement in their group about the measurement of each angle.
5. Have students name and list the different types of angles and angle pairs that they see in the diagram. Students may need a few reminders about definitions and relationships between angles or between lines and the angles formed by the intersection of the lines. Students may need to look up the definitions in a textbook or math dictionary.
6. Instruct students to answer the discovery questions.
7. Use student papers for class discussion or assignment.

Questions:

1. Ask students if each member of their group had the same angle measures. If not, ask them to explain why there was inconsistency in their measures.
   (Answer: Measurement accuracy, mistakes, and protractor calibrations)

2. Ask students to explain why many angles in the diagram had the same measure. Use this question to show the relationships between angles and between certain angle pairs.
   (Possible responses: Vertical angles are congruent. Linear pair angles are supplementary. If two parallel lines are cut by a transversal, then corresponding angles are congruent, alternate interior angles are congruent, same-side interior angles are supplementary, etc.)

ANGLE DISCOVERY SHEET



Directions

1. Using a protractor, measure angles 1-8.
2. Double-check measurements with other group members.
3. Answer the Discovery Questions below.

What types of angles and angle pairs are seen in the figure above? ____________________

____

Discovery Questions

1. Which angles have the same measure as $\angle 1$? ____________________
2. Which angles have the same measure as $\angle 2$? ____________________
3. List all pairs of angles whose measures add up to 180° ____________________

   ____
4. Which angles are acute? ____________________
5. Which angles are obtuse? ____________________
6. What is the relationship between $\angle 6$ and $\angle 7$? What is the name for this type of angle pair?

   ____
7. What is the relationship between $\angle 5$ and $\angle 1$? What is the name for this type of angle pair?

   ____
8. What is the relationship between $\angle 6$ and $\angle 4$? What is the name for this type of angle pair?

   ____
9. What is the relationship between $\angle 2$ and $\angle 7$? What is the name for this type of angle pair?

   ____
10. What is the relationship between $\angle 3$ and $\angle 4$? What is the name for this type of angle pair?

    ____

Answers to the Angle Discovery Sheet:

1. $\angle 4$, $\angle 5$ and $\angle 8$.
2. $\angle 3$, $\angle 6$ and $\angle 7$.
3. ($\angle 1$, $\angle 2$); ($\angle 2$, $\angle 4$); ($\angle 3$, $\angle 4$); ($\angle 1$, $\angle 3$); ($\angle 5$, $\angle 6$); ($\angle 6$, $\angle 8$); ($\angle 7$, $\angle 8$); ($\angle 5$, $\angle 7$); ($\angle 1$, $\angle 7$); ($\angle 3$, $\angle 5$); ($\angle 2$, $\angle 8$); ($\angle 4$, $\angle 6$); ($\angle 1$, $\angle 6$); ($\angle 3$, $\angle 8$); ($\angle 2$, $\angle 5$); ($\angle 4$, $\angle 7$).
4. $\angle 2$, $\angle 3$, $\angle 6$, $\angle 7$.
5. $\angle 1$, $\angle 4$, $\angle 5$, $\angle 8$.
6. They are congruent. Vertical Angles.
7. They are congruent. Corresponding Angles.
8. They are supplementary. Same-Side Interior Angles.
9. They are congruent. Alternate-Exterior Angles.
10. They are supplementary. Linear Pair (adjacent supplementary) Angles.

Reading/Writing Connection:

Reading Comprehension Standard II, Objective 2: Draw conclusions.

Reading Comprehension Standard IV, Objective 4: Demonstrate the ability to locate information in reference material.

Reading Comprehension Standard II, Objective 1: Identify main idea.

1. Drawing conclusions: This activity could be part of a "directed reading lesson." Use a vocabulary activity as a prereading activity and then use the "Discovery Sheet" as a guided reading activity. The students may draw conclusions to answer the questions provided on the "Discovery Sheet."

2. Locating information in reference material: Students could use a math dictionary, the glossary of a textbook, or the Internet to discover and/or review the definitions of the vocabulary terms related to this objective.

3. Identifying the main idea: Students could summarize the main idea of this discovery activity by writing about the angle relationships they learned through the activity.

ACTIVITY: Mix and Match Angle Identity

Purpose: To allow students to review a variety of angle types and angle pairs by associating the names of the angles with a drawing that illustrates the angles

Materials/Equipment:

Copies of the card sets (See pages C-108 and C-109.)	Scissors
Laminating machine	Prize/motivational reward

Procedure:

Before Class

1. Make copies of the set of cards on pages C-108-C-109. Each set of cards contains a card with the name of a type of angle or angle pair and a card with a picture that corresponds to the name of each angle or angle pair.
2. Laminating the cards will protect them for future use.
3. Cut out a set of cards for each group of students.
4. Mix up the cards. The picture cards and name cards should be mismatched and out of order.

During Class

1. Review the different types of angles and angle pairs.
2. Separate students into small groups and distribute a set of cards to each group.
3. Direct the groups to match the mixed-up cards by placing the angle or angle pair name next to its corresponding picture.
4. The first group to complete all the pairs could win a small prize. (e.g. - candy)

(NOTE: Teachers should remind students to match up cards so that each name card has only one picture card. Students will discover that several name cards could go with the same picture card. This can be a good class discussion topic about how some angle relationships have common characteristics.)

Questions:

1. What other picture card could be paired with Adjacent Angles? This card also has another property/relationship. What is the property? *(Answer: It could be paired with the picture card for linear pair angles. Linear pair angles are adjacent angles that are supplementary.)*

2. If the paired cards were divided into three groups, what would be the three groups? What is the reason for forming these three groups?

(Answer: 1. Congruent Angle Pairs – vertical angles, alternate interior angles, alternate exterior angles, and corresponding angles
2. Supplementary Angle Pairs – linear pair angles, same-side interior angles
3. Angle Types – acute, obtuse, complementary, supplementary, adjacent, right

The reasons for grouping should be related to the common relationship the angles have with each member of the group.)

Reading/Writing Connection:

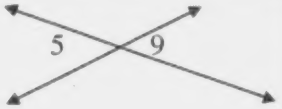
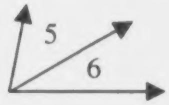
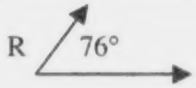
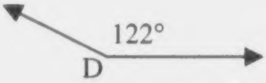
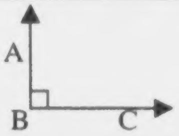
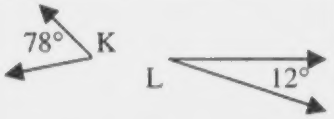
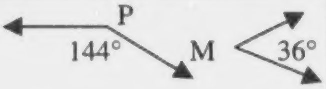
Reading Comprehension Standard IV, Objective 4: Demonstrate the ability to locate information in reference material.

Reading Comprehension Standard II, Objective 2: Draw conclusions.

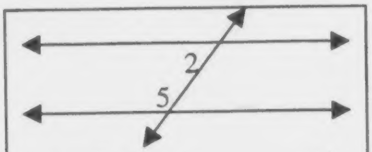
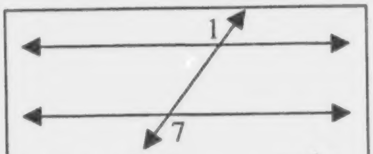
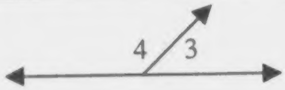
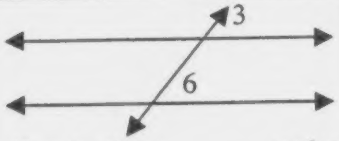
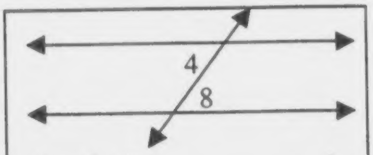
1. Locating information in reference material: This objective involves many geometric terms that will need to be reviewed and remembered. Students can spend time in a glossary or mathematics dictionary searching for the definitions of these terms.

2. Drawing conclusions in a writing assignment: Students could be given an assignment to write about the types of angles they find when looking at the front of their house from the street curb. Students should be encouraged to sketch a copy of the front of their house and label as many angle types and angle pairs as they can identify. Conclusions will be drawn as students name the types of angles in their drawings. A summary of their conclusions should be the main focus of the assignment.

Masters for Card Sets

Vertical Angles	 ∠5 and ∠9 are ______ angles
Adjacent Angles	 ∠ 5 and ∠ 6 are _____ angles
Acute Angle	 ∠ R is a(n) ______ angle
Obtuse Angle	 ∠ D is a(n) ______ angle
Right Angle	 ∠ ABC is a(n) ______ angle
Complementary Angles	 ∠ K and ∠L are ____ angles
Supplementary Angles	 ∠P and ∠M are ____ angles

Masters for Card Sets (continued)

Same-Side Interior Angles	 ∠ 2 and ∠ 5 are _____ angles
Alternate Exterior Angles	 ∠1 and ∠7 are _____ angles
Linear Pair Angles	 ∠4 and ∠3 are ______ angles
Corresponding Angles	 ∠3 and ∠6 are ______ angles
Alternate Interior Angles	 ∠4 and ∠8 are ______ angles

STANDARD VII: **The student will be able to solve problems involving a variety of algebraic and geometric concepts.**

OBJECTIVE 2: **Apply Pythagorean Theorem.**

ELIGIBLE CONTENT:

- **The Pythagorean Theorem will be given on the reference page.**
- **Diagrams will be included.**
- **Word problems will be used.**
- **Radicals may be included in options.**
- **All radicals will be simplified.**
- **Drawings will be to scale.**

NUMBER OF TEST ITEMS: 4

SUBJECT	LOCATION OF OBJECTIVE WITHIN THE COURSE OF STUDY	PAGE
8th Grade Math	25. Recognize and use the Pythagorean Theorem.	65
Introduction to Algebra	16. Apply the Pythagorean Theorem.	75
***Geometry**	29. Recognize and use Pythagorean Triples. 30. Apply the Pythagorean Theorem in problem solving using calculators when appropriate.	90 90
***Algebra II with Trig.**	49. Solve right triangles.	99

**Expansion/Review Material*

SUBJECT	PREREQUISITE SKILLS OR RELATED SKILLS FOR THIS OBJECTIVE WITHIN THE COURSE OF STUDY	PAGE
5th Grade Math	30. Identify triangles.	45
6th Grade Math	33. Develop understanding of geometric figures by drawing with a straightedge and/or a protractor. 42. Demonstrate an understanding of exponential notation. 43. Extend the understanding of the order of operations.	51 53 53

SUBJECT	PREREQUISITE SKILLS OR RELATED SKILLS FOR THIS OBJECTIVE WITHIN THE COURSE OF STUDY (cont.)	PAGE
7th Grade Math	9. Evaluate powers of whole numbers and roots of perfect squares.	55
8th Grade Math	6. Apply the laws of exponents to simplify expressions containing integral exponents.	62
	7. Find square roots of rational numbers.	62
Introduction to Algebra	4. Recognize, simplify, and use irrational numbers.	74
	9. Demonstrate proficiency in simplifying rational number expressions using the order of operations.	74
	12. Apply the laws of exponents to simplify expressions containing natural number exponents.	75
Algebra I	4. Use the order of operations, including exponentiation, to simplify numeric and variable expressions.	80
	5. Perform operations involving square roots with and without calculators.	80
	20. Perform basic operations on algebraic expressions.	82
	21. Evaluate algebraic expressions.	82
	22. Know and use laws of exponents including zero and negative integral exponents.	82
***Geometry**	1. Construct line segments whose lengths are irrational.	88
	25. Apply formulas of coordinate geometry.	90
	31. Solve an equation involving radicals.	90
***Algebra II with Trig.**	13. Apply the distance and midpoint formulas to coordinate geometry.	95
	24. Solve equations involving radicals.	97
***Advanced Mathematics**	3. Express complex numbers in trigonometric form.	104
	9. Determine norms of vectors.	104
***Mathematics in Society**	16. Demonstrate an understanding of the role of geometry in society.	112

**Expansion/Review Material*

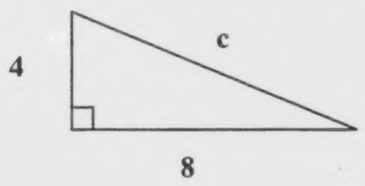
TEACHER OVERVIEW

Student will need to recognize the Pythagorean Theorem and be able to simplify expressions that contain exponents and square roots. Instruction should deal with development of the Pythagorean Theorem. This will allow students to have a deeper understanding of the concept and not just memorize a formula. Patty paper activities provide an excellent avenue for discussing the Pythagorean Theorem. After completing the activities that follow, students should be given the opportunity to solve problems involving the Pythagorean Theorem.

Vocabulary: legs, hypotenuse, right triangle

Sample Problems:* *Applications of the Pythagorean Theorem

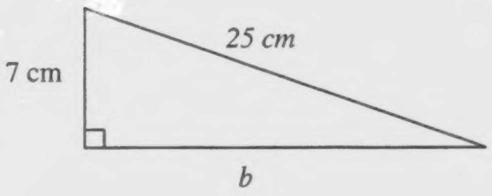
1. Find the length of c in the right triangle.



Solution:

$$\begin{aligned} 4^2 + 8^2 &= c^2 \\ 16 + 64 &= c^2 \\ 80 &= c^2 \\ \sqrt{80} &= c \\ \sqrt{16} \bullet \sqrt{5} &= c \\ 4\sqrt{5} &= c \end{aligned}$$

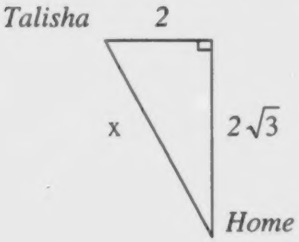
2. A right triangle has an hypotenuse length of 25 cm and one of the legs has a length of 7 cm. Find the length of the other leg of this triangle.



Solution: Let b represent the length of the missing leg. Then, by the Pythagorean Theorem:

$$\begin{aligned} 7^2 + b^2 &= 25^2 \\ 49 + b^2 &= 625 \\ b^2 &= 576 \\ b &= \sqrt{576} \\ b &= 24 \text{ cm} \end{aligned}$$

3. Talisha started from home and walked $2\sqrt{3}$ miles north and then turned west and walked for 2 more miles. If she could walk a straight path, how far is Talisha from her home?



Solution: Let x represent the distance back to Talisha's home Then, by the Pythagorean Theorem:

$$\begin{aligned} 2^2 + (2\sqrt{3})^2 &= x^2 \\ 4 + (4 \bullet 3) &= x^2 \\ 4 + 12 &= x^2 \\ 16 &= x^2 \\ 4 &= x; \text{ (4 miles)} \end{aligned}$$

ACTIVITY: Understanding the Pythagorean Theorem

Purpose: To expose students to an illustration of the statement of the Pythagorean Theorem *(The sum of the squares of the legs of a right triangle equals the square of the hypotenuse.)*

Materials/Equipment:

Large square graph paper (so that each group may have two pieces)
Straightedge (for each group)
Safety scissors (for each group)

Procedure:

1. Divide the class into groups of two and give each pair two sheets of graph paper, a straightedge, and safety scissors.
2. Tell students to construct a right triangle with legs of 3 and 4 unit squares.
3. Next, tell students to use the graph paper to form a square with sides of 3 units, another square with sides of 4 units, and a third square with sides the same length as the hypotenuse of the triangle.
4. Have the students cut apart the two smaller squares and fit the pieces into the larger square. All pieces of the smaller squares should exactly fill the larger square.
5. Use the following questions to facilitate class discussion.

Questions:

1. How many unit squares are there in the square with sides of 3? *(Answer: 9)*
2. How many unit squares are there in the square with sides of 4? *(Answer: 16)*
3. What is the length of the hypotenuse? *(Answer: 5)*
4. How many unit squares are located in the square with sides having the length of the hypotenuse? *(Answer: 25)*
5. Write a statement or paragraph that tells what has been discovered.
   (Possible responses: Student responses should include statements about the sum of the unit squares in the two smaller squares being equal to the total number of unit squares in the large square.)
6. Would this rule work with right triangles having sides with different lengths than the right triangle used in this activity?
   [Answer: Yes. Students should discover other integral side lengths such as 5, 12, and 13; 8, 15, and 17; and 7, 24, and 25. They could also include multiples of the triples like 6, 8, and 10 that have been shown thus far.]

Reading/Writing Connection:

Reading Comprehension Standard II, Objective 2: Draw conclusions.
Reading Comprehension Standard I, Objective 2: Determine sequence of events.

1. Drawing conclusions: Write a formula that expresses the conclusions that have been derived concerning this activity.

2. Sequencing/Ordering: Using the derived formula, write in complete sentences the order that must be followed to find the length of the hypotenuse of a right triangle when given the lengths of the two legs.

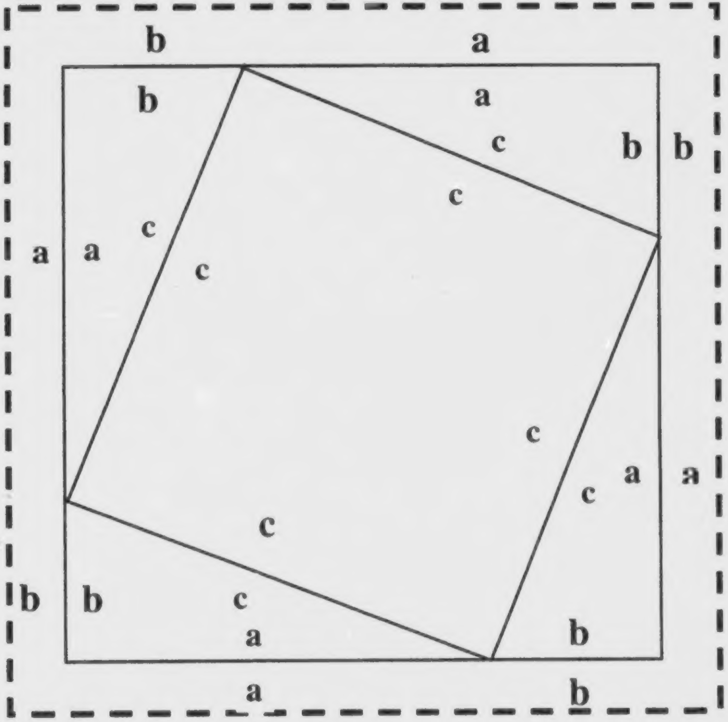
ACTIVITY: Triangle Cutting Activity

Purpose: To allow students to discover the Pythagorean Theorem from an algebraic approach that uses the area of geometric figures

Materials/Equipment:

Copies of the square shown below Safety scissors Pencil and paper

(cut along dotted line)



Procedure:

1. Divide the class into pairs and give each student a cut-out copy of the square. Give a pair of scissors to each group.
2. Tell students to write an expression on their paper that represents the area of the large square they have been given. *[Answer: $(a + b)^2$]*
3. Tell students to cut out the small square by cutting off each triangle of the big square along the hypotenuse of each triangle.
4. Tell students to write an expression on their paper that represents the area of each of the four triangles that were cut from the big square. *[Answer: $\frac{1}{2}ab$]*
5. Tell students to write an expression on their paper that represents the area of the smaller square that they just cut out from the larger square. *[Answer: c^2]*
6. Tell students to make the following column headings:

Area of Large Square	Area of 4 Triangles	Area of Small Square

7. Tell students to fill in each column with the answers found above. Then tell them to use the columns to set up an equation that shows how to find the total area of the large square twodifferent ways.

   Desired Equation is : $(a + b)^2 = 4\left(\frac{1}{2}ab\right) + c^2$

8. Tell students to verify that their equation is correct and then tell them to simplify the equation. The steps are shown below.

$$\begin{aligned} (a + b)^2 &= 4\left(\frac{1}{2}ab\right) + c^2 \\ a^2 + 2ab + b^2 &= 2ab + c^2 \\ a^2 + b^2 &= c^2 \end{aligned}$$

Questions:

1. The area of the large square can be found in two ways. Briefly discuss the two methods for finding the area of the large square.
   (Answer: The area can be found by squaring the length of the side of the large square to get $(a + b)^2$) or by adding the areas of the four triangles and the small square together to get $c^2 + 4\left(\frac{1}{2}ab\right)$. These areas were shown to be equal in the previous activity.)
2. What must be true about the four triangles cut from the large square?
   (Answer: They are all congruent right triangles.)
3. Algebraically this activity results in the equation $\underline{a^2 + b^2 = c^2}$. What does this equation represent with respect to one of the triangles cut from the large square?
   (Answer: The sum of the squares of the lengths of the legs of a right triangle equals the square of the length of the hypotenuse. This is the Pythagorean Theorem.)
4. What are some possible values of a, b, and c that make this equation true? Verify answers by checking the area of the figures formed. *(Possible Answers: 3, 4 , 5 and 5, 12, 13)*

Reading/Writing Connection:

Reading Comprehension Standard IV, Objective 3: Discern organizational patterns.

Reading Comprehension Standard III, Objective 1: Recognize fallacies of logic and judge strength of argument.

1. Summarizing: Write a short paragraph explaining the following equation.
$$\mathbf{a^2 + b^2 = c^2}$$

2. Faulty logic: Discuss the faulty logic involved in the following incorrect statement.
$$\begin{aligned}\sqrt{5^2+12^2} &= \sqrt{17^2} \\ &= 17\end{aligned}$$

ADDITIONAL RESOURCES:

1. *Basic Geometry*, Jurgensen, Brown; Houghton Mifflin, 1990, p. 255.
2. *Patty Paper Geometry*, Michael Serra, Key Curriculum Press, 1994, p. 219.

STANDARD VII: **The student will be able to solve problems involving a variety of algebraic and geometric concepts.**

OBJECTIVE 3: Apply properties of similar polygons.

ELIGIBLE CONTENT:
- **Diagrams may be included.**
- **Drawings will be to scale.**
- **The word *similar* or the symbol "~" may be used.**
- **Use of the scale factor will be required.**

NUMBER OF TEST ITEMS: 4

SUBJECT	LOCATION OF OBJECTIVE WITHIN THE COURSE OF STUDY	PAGE
7th Grade Math	26. Determine measurement indirectly from similar figures and scale drawings.	57
8th Grade Math	19. Produce measurements indirectly from similar geometric figures and drawings.	64
Introduction to Algebra	29. Use scale drawings and geometric models to solve problems.	76
***Geometry**	35. Apply properties of similar polygons in problem solving.	90
***Mathematics in Society**	15. Produce a scale drawing of two- and three-dimensional objects.	112

**Expansion/Review Material*

SUBJECT	PREREQUISITE SKILLS OR RELATED SKILLS FOR THIS OBJECTIVE WITHIN THE COURSE OF STUDY	PAGE
5th Grade Math	25. Determine measurements indirectly from scale drawings. 32. Develop an understanding of similarity.	45 46
6th Grade Math	16. Use ratios and proportions to describe real-life situations. 26. Determine measurements indirectly from scale drawings.	50 51

SUBJECT	PREREQUISITE SKILLS OR RELATED SKILLS FOR THIS OBJECTIVE WITHIN THE COURSE OF STUDY (cont.)	PAGE
7th Grade Math	16. Solve problems using ratios and/or proportions. 20. Develop spatial sense by constructing and drawing two- and three-dimensional scale models.	56 57
8th Grade Math	13. Solve problems with ratios and proportions.	63
Introduction to Algebra	5. Write and use ratios to compare one quantity with another. 6. Use ratios and proportions in problem solving.	74 74
Algebra I	35. Solve problems involving direct variation and inverse (indirect) variation.	83
***Geometry**	33. Solve a problem using ratio or proportion.	90

**Expansion/Review Material*

TEACHER OVERVIEW

Students generally understand similar figures by working with a given pair of similar figures and determining the missing length of a side or the missing measure of an angle. A review of ratios and proportions might be necessary before beginning the Scaled-Up Candy Bars activity. The symbol "~" is used to represent similarity.

Vocabulary: ratio, proportion, similar figures (polygons), scale factor, congruent figures (polygons), similarity

ACTIVITY: Scaled-Up Candy Bars*

Purpose: To create a larger version of an original candy-bar wrapper to illustrate similarity *(NOTE: This activity gives students the opportunity to draw a similar figure.)*

Materials/Equipment:

1 candy bar per student
1 piece of graph paper with 1-inch grids for each student
Crayons
Tape
¼-inch grid transparency (one per student)
String
Newspapers
Stapler/staples

Procedure:

1. Instruct students to remove the candy bar carefully from its wrapper with as few tears as possible.
2. Students can eat the candy bar.
3. Place the ¼-inch grid transparency on top of the candy wrapper and secure it with tape. (HINT: Make sure the tape is on the smooth side of the transparency.)
4. Transfer square by square what is seen on the transparency to the large graph paper. The contents of each square should be drawn.
5. Color the candy wrapper the same color as the original wrapper.
6. Fold the paper to make the candy bar wrapper (front and back). Staple together.
7. Measure the length of the original wrapper and the length of the new wrapper. Find the scale factor using length of original wrapper to length of new wrapper ratio.
8. Measure the width of the original wrapper. Using the scale factor, set up the proportion using original length : new length as original width : new width.
9. Solve the proportion to discover the new width. Measure the new width to check accuracy.
10. Stuff with newspaper.
11. Hang from the ceiling.

Questions:

1. What can be observed about the process for enlarging the wrapper?
2. How did using the grid paper help in the process of enlarging the wrapper?
3. Name real-life situations where objects need to be enlarged.

Reading/Writing Connection:

Reading Comprehension Standard II, Objective 5: Recognize statements that adequately summarize a passage.
Reading Comprehension Standard IV, Objective 3: Discern organizational patterns.

Write a paragraph summarizing the procedure. Discuss the scale factor of the new wrapper as compared to the original wrapper.

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Activity: Find Your Mate

Purpose: To help students learn the process for solving problems involving similar polygons

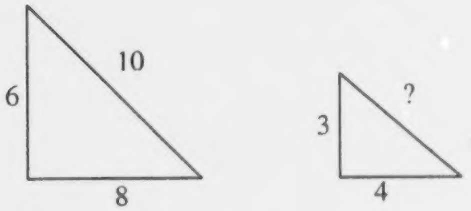
Materials/Equipment:

2 sets of colored index cards

Preparation of index cards:

1. On one set of the index cards, draw different geometric shapes such as right triangles, equilateral triangles, squares, rectangles, and trapezoids.
2. Label the length of each side.
3. On the other set of index cards, draw the same types of polygons listed in Step 1. Make each polygon in the second set larger or smaller than those in the first set.
4. Label the length of all but one side of each polygon in this set.

EXAMPLE



Procedure:

1. Distribute one card to each student.
2. Have the students find the matching shapes.
3. Once all cards have a mate, have the students find the scale factor. In the example above, the scale factor would be 3:6 or 4:8 = 1:2 (Note the scale factor used is small to large.)
4. Have students find the length of the missing (unlabeled) side. In the example above, replace the ? with x. The missing side would be found by solving $\frac{3}{6} = \frac{x}{10}$. This means 30 = 6x or 5 = x.
5. Collect the cards.
6. Repeat Steps 1 through 5 with other cards for additional practice.

Questions:

1. Explain how congruent and similar polygons are alike. Then explain how they are different. *(Answer: If two polygons are congruent, the measures of their corresponding sides and corresponding angles are equal. If two polygons are similar, the measures of their corresponding sides are proportional; and the measures of their corresponding angles are equal.)*
2. Are congruent triangles also similar triangles? Why or why not? *(Answer: Yes. Congruent triangles are also similar triangles based on the definition of similar triangles (polygons). The corresponding sides are in proportion 1:1, and the corresponding angles are equal.)*

Reading/Writing Connection:

Reading Comprehension Standard IV, Objective 3: Discern organizational patterns.

If each of two polygons is similar to a third polygon, are the two polygons similar to each other? Write a paragraph explaining why or why not. Draw a picture to illustrate the reason for the answer.

STANDARD VII: **The student will be able to solve problems involving a variety of algebraic and geometric concepts.**

OBJECTIVE 4: **Apply properties of plane and solid geometric figures.**

ELIGIBLE CONTENT:
- **Diagrams may be included.**
- **Word problems may be used.**
- **The following content may be included:**
  - **area and perimeter of triangles, rectangles, and squares**
  - **area and circumference of a circle, given radius or diameter**
  - **perimeter of a regular polygon, given one side**
  - **volume of rectangular prism or cylinder**
  - **sum of the measures of the angles in a triangle**
  - **sum of the measures of the angles in a rectangle**
- **Determining any dimension of a figure may be required.**
- **Determining any dimension of a figure when the dimension is expressed as an algebraic expression may be required.**

NUMBER OF TEST ITEMS: 4

SUBJECT	LOCATION OF OBJECTIVE WITHIN THE COURSE OF STUDY	PAGE
7th Grade Math	22. Solve real-life measurement problems. 23. Exhibit proficiency in determining perimeter and area of regular plane geometric figures. 25. Apply appropriate formulas to find perimeter, circumference, surface area, area, and volume.	57 57 57
8th Grade Math	17. Solve measurement problems by using mental math, paper and pencil, and estimation techniques as well as appropriate units of measure. 18. Demonstrate proficiency in measuring to find perimeter, area, and volume using customary and metric units. 27. Determine measures associated with plane and solid geometric figures using given formulas.	64 64 65
Introduction to Algebra	15. Apply properties of plane and solid geometric figures to solve problems. 18. Deduce lengths of the sides of polygons from given assumptions. 19. Given the formulas, use perimeter, area, surface area, circumference, or volume of geometric figures to solve problems.	75 76 76

SUBJECT	LOCATION OF OBJECTIVE WITHIN THE COURSE OF STUDY (cont.)	PAGE
Algebra I	8. Apply the perimeter and area of a polygon to solve problems, given the formulas.	80
	9. Determine the volume and surface area of geometric solids, given the formulas.	81
	10. Solve problems involving the area and circumference of a circle, given the formulas.	81
*Geometry	5. Determine area and circumference of a circle.	88
	9. Determine perimeter and area of polygons.	89
	10. Find the area of an inscribed or a circumscribed polygon or circle.	89
	11. Find the surface area and volume of cylinders, spheres, and prisms, given the formulas.	89
	16. Apply properties and measures associated with triangles and quadrilaterals to solve problems.	89
	18. Deduce the measure of angles associated with polygons from given information.	89
	23. Find the area of a rectangle or triangle, given the coordinates of the vertices.	90
*Algebra II with Trig.	16. Use perimeter, area, and volume formulas to solve word problems.	95
*Mathematics in Society	13. Apply perimeter, area, and volume formulas in problem solving.	112

**Expansion/Review Material*

SUBJECT	PREREQUISITE SKILLS OR RELATED SKILLS FOR THIS OBJECTIVE WITHIN THE COURSE OF STUDY	PAGE
5th Grade Math	20. Compare lengths, areas, volumes, and weights of objects using physical materials and pictorial and numerical representations.	44
	22. Estimate and calculate perimeter and area.	45
	29. Identify and draw parts of a circle.	45

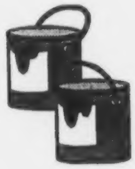
SUBJECT	PREREQUISITE SKILLS OR RELATED SKILLS FOR THIS OBJECTIVE WITHIN THE COURSE OF STUDY (cont.)	PAGE
6th Grade Math	24. Estimate perimeters and areas.	51
	25. Calculate areas and perimeters in meaningful context.	51
	29. Exhibit proficiency in drawing and labeling parts of a circle.	51
	30. Establish formulas for determining perimeter, area, volume, and circumference through a variety of explorations.	51
7th Grade Math	15. Use problem-solving strategies effectively.	56
	16. Solve problems using ratios and/or proportions.	56
	27. Identify plane and solid geometric figures.	57
Introduction To Algebra	14. Use problem-solving strategies effectively.	75
*Geometry	20. Describe and identify parts of circles.	89
	21. Apply properties and theorems related to circles.	89
*Mathematics in Society	14. Use symmetry, perspective, spatial representations, or patterns to evaluate and/or create works of art.	112
*Advanced Mathematics	48. Determine the area of oblique triangles.	107

**Expansion/Review Material*

TEACHER OVERVIEW

A review of area formulas and square units may be necessary. Go over these with students before beginning these activities. The formulas for area, perimeter, volume, and circumference will be provided on the reference page in the test booklet.

ACTIVITY: Painting Project



Purpose: To use the area formula to find how many gallons of paint will be needed to paint the interior walls

(NOTE: One gallon of paint will cover approximately 425 square feet.)

Materials/Equipment:

Pencil	Floor plans
Paper	Guidelines for painting (See Step 4 of the procedure.)

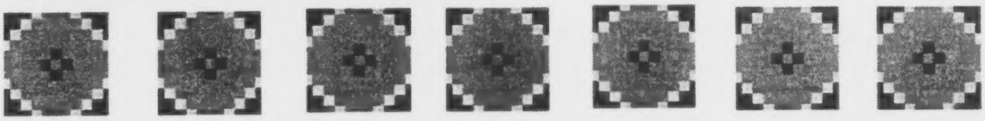
Procedure:

1. Distribute copies of the guideline for painting to students.
2. Divide the class into groups of four.
3. Give each group a copy of the same floor plan or provide a different one for each group of four.
4. Have the students determine how many gallons of paint are needed to paint the interior walls and the ceilings of the house using the guidelines:
   a. All walls and ceilings are to be painted.
   b. All the ceilings are 8 ft. high.
   c. All the windows are 3 ft. x 4 ft.
   d. The front door is 5 ft. x 7 ft.
   e. The doors to all bedrooms are 4 ft. x 7 ft. rectangles.
   f. All other doorways are open arches (a semicircle on top of a 4 ft. wide x 5 ft. high rectangle).
   g. For simplicity, do not consider wall thickness in arched doorways and fixtures such as cabinets, bathtubs.

Questions:

1. Why are square units used when measuring area as opposed to cubic units used when measuring volume? *(Answer: Area is used to measure two-dimensional objects, and volume is used to measure three-dimensional objects.)*
2. How much paint will be used if two coats of paint are applied? How much paint will be used if three coats of paint are applied? *(Answers will vary according to the floor plan.)*
3. How much carpet will be needed if carpet is to be placed in the bedrooms and living room/den? *(Answers will vary according to the floor plan.)*
4. How much floor space is left to cover after carpeting the floors discussed in question #3? *(Answers will vary according to the floor plan.)*

ACTIVITY: Decorating with a Border



Purpose: To use the perimeter formula to find how much border will be needed to decorate one room

Procedure:

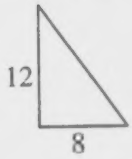
Using the same floor plan from the "Painting Project" activity, determine how much wallpaper border will be needed to go around one of the rooms. Designate which of the rooms students should use.

Questions:

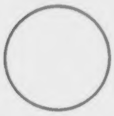
1. How does the perimeter formula differ from the area formula? *(Answer: The perimeter formula for rectangles is 2 times length + 2 times width, and the area formula is length times width.)*
2. What units are used in measuring perimeter? How are the units different from those used to measure area? *(Answer: Perimeter is measured in linear units of measure, and area is measured in square units of measure.)*

Extension:

1. Give students problems to solve such as the following:
   - A 12-foot tree casts an 8-foot shadow. Find the area of the triangle that is formed by connecting the top of the tree to the end of the shadow. *(Answer: 48 square feet)*



   - A peach pie has a circumference of 10 π inches. Find the area of the pie. *(Answer: 25π square inches)*



   - The sum of the degree measures of the angles of a triangle is 180. Find the measures of the three angles of triangle ABC. Angle A has measure (2x + 1), angle B has measure (5x – 2), and angle C has measure (3x + 11). *(Answer: 35°, 83°, 62°)*
2. Assign other problems using area, perimeter, and volume of geometric figures.

Reading/Writing Connection:

Reading Comprehension Standard II, Objective 1: Identify main idea.
Reading Comprehension Standard IV, Objective 3: Discern organizational patterns.

1. Design a floor plan for a house and find the amount of paint needed to paint the house.
2. Write a paragraph describing the house plan.
3. Find and read an article on interior decorating. Determine the main idea for each of three paragraphs from that article.

STANDARD VII: **The student will be able to solve problems involving a variety of algebraic and geometric concepts.**

OBJECTIVE 5: **Determine measures of central tendency.**

ELIGIBLE CONTENT:

- **The word "mean" will be used for the arithmetic average.**
- **The set of numbers used to assess the range will not be in numerical order.**
- **Decimals up to hundredths may be used.**
- **Decimals with different numbers of decimal digits may be used in the same item.**
- **Frequency diagrams may be used.**

NUMBER OF TEST ITEMS: 4

SUBJECT	LOCATION OF OBJECTIVE WITHIN THE COURSE OF STUDY	PAGE
7th Grade Math	51. Exhibit proficiency in determining mean, mode, median, and range for a set of data. 52. Apply measures of central tendency and dispersion to real-life situations.	60 60
8th Grade Math	41. Analyze and/or extrapolate data from frequency tables, stem-and-leaf plots, histograms, scattergrams, tally charts, single- and multiple-bar graphs, single- and multiple-line graphs, circle graphs, and published studies. 42. Use mean, median, mode, and range to analyze statistical data.	67 67
Introduction to Algebra	40. Interpret data and draw inferences from tables, charts, and graphs. 41. Compute and use measures of central tendency to analyze statistical data.	77 77
Algebra I	45. Identify the effect on mean, median, mode, and range when a set of data is changed.	84

SUBJECT	PREREQUISITE SKILLS OR RELATED SKILLS FOR THIS OBJECTIVE WITHIN THE COURSE OF STUDY	PAGE
5th Grade Math	9. Add, subtract, and multiply decimals. 45. Extrapolate data from frequency tables, charts, bar graphs, and line graphs. 48. Describe data using measures of central tendency and dispersion.	43 47 47
6th Grade Math	6. Demonstrate proficiency in adding, subtracting, and multiplying decimals. 7. Divide decimals. 45. Collect, organize, and interpret data using graphs, tables, and charts. 46. Determine measures of central tendency and dispersion.	49 49 53 53
7th Grade Math	50. Analyze and/or extrapolate data from lists, circle graphs, tables, single- and multiple-line graphs, single- and multiple-bar graphs, and tally charts.	60
***Algebra II with Trig.**	66. Solve problems involving normal distributions.	100
***Advanced Mathematics**	72. Read and interpret normal distribution curves.	109
***Mathematics in Society**	30. Interpret statistical analyses in sports and subsequent changes. 35. Solve problems involving normal distribution.	114 114

**Expansion/Review Material*

TEACHER OVERVIEW

Explain the four measurements of central tendency: mean, median, mode, and range. In the eligible content, only mean and range are specifically listed, but Objective 5 indicates that students should be able to determine all measures of central tendency. A thorough review of mean, median, mode, and range will be needed. For this activity, visiting a cemetery is recommended; although any data with numbers can be used. Variations may include scores of local sporting events, weather temperatures over a time period, or the number of each color of M&M® in a bag of M&Ms®. After the activity, give students specific assignments related to finding the mean, median, mode, and range of a set of data.

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ACTIVITY: Cemetery Statistics*

Purpose: To work with students in gathering data and applying the four measurements of central tendency

Materials/Equipment:

Pencil
Paper
Access to a local cemetery

Procedure:

1. Give each student copies of Chart 1 and Chart 2.
2. Visit a local cemetery.
3. Have students collect data from a minimum of 50 tombstones. They should use the first chart to record the following data.
   - Name
   - Male or female
   - Date of birth (month/year)
   - Date of death (month/year)
4. Students should calculate the age of each person at death.
5. Go over methods for finding the mean, median, mode, and range of a set of data with students.
6. Ask students to answer the following questions and complete the second chart.

Questions:

1. What is the range for the age of men at death and the range for the age of women at death?
2. What is the average year of birth and the average year of death?
3. What is the mean age of men at death and the mean age of women at death?
4. What is the median age of men at death and the median age of women at death?
5. What is the mode month of birth and the mode month of death?
6. What is the mode year of birth and the mode year of death?
7. What is the percent of people who died within a month following their birthdays?

Reading/Writing Connection:

Reading Comprehension Standard II, Objective 5: Recognize statements that adequately summarize a passage.

Write a paragraph summarizing the cemetery project.

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CHART 1

Name of Cemetery ______________________ **Student** __________________________

Location ______________________________

NAME	MALE/ FEMALE	DATE OF BIRTH	DATE OF DEATH	AGE AT DEATH

CHART 2

Name Of Cemetery ____________________ Student ____________________________

Location ___________________________

CATEGORY EVALUATED	TOTAL COUNT
Number of Males	
Number of Females	
Number of Unidentified	
% of Males	
% of Females	
% of Unidentified	
Range for the age of men at death	
Range for the age of women at death	
Average year of birth	
Average year of death	
Average age of men at death	
Average age of women at death	
Median age of men at death	
Median age of women at death	
Mode month of birth	
Mode month of death	
Mode year of birth	
Mode year of death	
% of people who died within a month following their birthday	

STANDARD VII: **The student will be able to solve problems involving a variety of algebraic and geometric concepts.**

OBJECTIVE 6: **Determine probabilities.**

ELIGIBLE CONTENT: • **Both AND and OR situations may be included.**

NUMBER OF TEST ITEMS: 4

SUBJECT	LOCATION OF OBJECTIVE WITHIN THE COURSE OF STUDY	PAGE
7th Grade Math	55. Determine permutations and combinations.	60
8th Grade Math	46. Exhibit an understanding of permutations and combinations. 47. Determine the probability of simple events, complementary events, and mutually exclusive events.	68 68
Introduction to Algebra	42. Demonstrate an understanding of probability.	78
Algebra I	46. Predict outcomes for simple events, given the probabilities. 47. Predict outcomes of compound events, given the probabilities. 49. Find probabilities, given graphs of probability distributions or tables of outcomes.	84 84 84
***Algebra II with Trig.**	64. Find probability.	100
***Mathematics in Society**	26. Determine probability of real-life events. 33. Find probability.	113 114

**Expansion/Review Material*

SUBJECT	PREREQUISITE SKILLS OR RELATED SKILLS FOR THIS OBJECTIVE WITHIN THE COURSE OF STUDY	PAGE
5th Grade Math	46. Determine probabilities from experiments and simulations. 47. Make inferences and predict outcomes from collected data.	47 47
6th Grade Math	47. Make predictions and verify outcomes of independent events. 48. Express the probability of the occurrence of an event as a fraction and as a decimal. 49. Use combinations and permutations in context.	53 53 53

SUBJECT	PREREQUISITE SKILLS OR RELATED SKILLS FOR THIS OBJECTIVE WITHIN THE COURSE OF STUDY (cont.)	PAGE
7th Grade Math	54. Determine possible outcomes of an event and compare with experimental outcomes.	60
8th Grade Math	45. Determine possible outcome(s) of an event and compare with experimental outcomes.	67
Algebra I	48. Estimate probabilities, given experimental data or graphs.	84
***Algebra II with Trig.**	62. Make predictions from statistical samples.	100
***Mathematics in Society**	28. Predict outcomes, given the probability in real-life situations. 31. Make predictions from statistical samples. 32. Solve problems using enumeration procedures.	113 114 114

**Expansion/Review Material*

TEACHER OVERVIEW

Students should understand elementary notions of probability to determine the likelihood of future events. The probability of an event, P, is the number of favorable outcomes divided by the total number of outcomes. ($0 \leq P \leq 1$)

In probability problems involving two events, "AND" means that the intersection (common elements) of the favorable outcomes from the two events is used to find probability. In situations involving "OR", the union of the favorable outcomes for the two events is used to find probability. (In the union of two sets, elements are listed only once.) *(See examples under the procedure.)*

***Vocabulary*:** outcomes, favorable outcomes, probability

ACTIVITY: A Fish Story

Purpose: To introduce probability through a physical activity

Materials/Equipment:

20 fish shapes cut from construction paper or felt and numbered as follows.

Two red—1, 2	Four green—1, 2, 3, 4
Six blue—1, 2, 3, 4, 5, 6	Eight yellow—1, 2, 3, 4, 5, 6, 7, 8

Cardboard box with a cutout for drawing out fish (the pond)
Handout of tables (sample)
(NOTE: Colored counters, numbered with a permanent marker, may be substituted for the fish.)

Draw #	Result
1	Red, 1
2 . . .	Blue, 2
20	. . .

Procedure:

1. Have a student draw a fish from the pond.
2. Have all students record the result.
3. Have the student return the fish to the pond.
4. Have another student draw a fish from the pond.
5. Repeat Steps 1-4 for a total of 20-60 draws.
6. Ask students to predict the probability of several different events. Ask questions such as:
    - What is the probability of drawing a red fish or a green fish? *(Answer: P(red or green) = P(red) or P(green) = 2/20 + 4/20 = 6/20 = 3/10)*
    - What is the probability of drawing a yellow or an odd-numbered fish? *(Answer: P(yellow or odd) = P(yellow) + P(odd) – P(yellow & odd), since these events are not mutually exclusive. P(yellow or odd) = 8/20 + 10/20 – 4/20 = 14/20 = 7/10. Another possibility is to explain that there are a total of 20 fish from which a draw may occur. The number possible becomes the denominator of the ratio of probability. There are 8 yellow fish and 6 odd-numbered fish that are not yellow. This gives a total of 14 fish that would meet the requirements of the problem. The probability of drawing one of these fish would be 14 out of 20 or 14/20 or 7/10.)*
    - What is the probability of drawing a blue and an even-numbered fish? *(Answer: 3/20)*
7. Let the students ask questions about other events.
8. The teacher then makes an assignment for individual practice. (A spinner with different-colored sections that are numbered can also be used for this activity.)

Reading/Writing Connection:

Reading Comprehension Standard I, Objective 1: Identify supporting details.
Reading Comprehension Standard II, Objective 3: Determine cause and effect.

Questions:

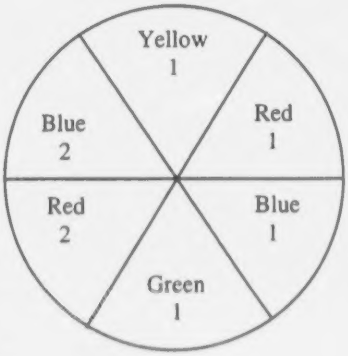
1. What happens to P(yellow) if the number of each color of fish is doubled ?
2. What happens to P(red) if half of the yellow fish are removed from the pond?
3. Why is the probability of an event zero-to-one inclusive?
4. Give three examples to show that finding probability is a useful skill.

ACTIVITY: A Spin On Probability

***Purpose*:** To increase students' understanding of the principles of probability through recording and analyzing data

***Materials/Equipment*:**

Spinners divided by color and number
Tally sheets
Graphing calculators (optional)



***Procedure*:**

1. Students will work in cooperative groups of two to four.
2. Each group is given a spinner and a tally sheet.
3. Each group spins at least 100 times and records the results.
4. The teacher asks:
   a. What color or colors occur most often in 100 spins? *(Answers for a, b, and c depend on the class results.)*
   b. What number occurs most often?
   c. What factors affect the outcomes?
   d. Without spinning—
   What is the probability of getting a yellow? *(Answer: P(yellow) = 1/6)*
   What is the probability of getting the number 1? *(Answer: P(one) = 2/3)*
   What is the probability of getting a blue and a 1? *(Answer: P(blue and one) = 1/6)*
   (Other questions may be added.)
5. Extensions: Groups may prepare a frequency polygon for the 100 spins and compare experimental outcomes to expected outcomes (probabilities).
6. Students may enter data in a graphing calculator and find the resulting graph.

Tally Sheet:

SPINNER RESULTS	FREQUENCY
Red, 1	
Red, 2	
Blue,1	
Blue, 2	
Green, 1	
Yellow, 1	

***Reading/Writing Connection*:**

Reading Comprehension Standard III, Objective 1: Recognize fallacies of logic and judge strength of argument.

Reading Comprehension Standard IV, Objective 4: Demonstrate the ability to locate information in reference material.

Research the uses and misuses of probability. Write a short paper listing specific details about three uses and three misuses of probability.

STANDARD VII: **The student will be able to solve problems involving a variety of algebraic and geometric concepts.**

OBJECTIVE 7: **Solve problems involving direct variation.**

ELIGIBLE CONTENT:
- **Diagrams may be used.**
- **Verbal descriptions of proportions may be used.**

NUMBER OF TEST ITEMS: 4

SUBJECT	LOCATION OF OBJECTIVE WITHIN THE COURSE OF STUDY	PAGE
7th Grade Math	16. Solve problems using ratios and/or proportions.	56
8th Grade Math	13. Solve problems with ratios and proportions.	63
Introduction to Algebra	6. Use ratios and proportions in problem solving.	74
Algebra I	35. Solve problems involving direct variation and inverse (indirect) variation.	83
***Geometry**	33. Solve a problem using ratio or proportion.	90

**Expansion/Review Material*

SUBJECT	PREREQUISITE SKILLS OR RELATED SKILLS FOR THIS OBJECTIVE WITHIN THE COURSE OF STUDY	PAGE
5th Grade Math	10. Model and relate percents to parts of 100 using equivalent fractions and decimals. 19. Apply a variety of strategies to solve problems with an emphasis on multi-step and non-routine problems.	43 44
6th Grade Math	16. Use ratios and proportions to describe real-life situations. 19. Develop and apply a variety of strategies to solve problems with an emphasis on multi-step and non-routine problems.	50 50
7th Grade Math	15. Use problem-solving strategies effectively. 26. Determine measurement indirectly from similar figures and scale drawings.	56 57
8th Grade Math	11. Use problem-solving strategies effectively.	63

SUBJECT	PREREQUISITE SKILLS OR RELATED SKILLS FOR THIS OBJECTIVE WITHIN THE COURSE OF STUDY (cont.)	PAGE
Introduction to Algebra	7. Recognize percents as ratios. 14. Use problem-solving strategies effectively.	74 75
Algebra I	32. Solve word problems using a variety of methods.	83
***Geometry**	35. Apply properties of similar polygons in problem solving.	90

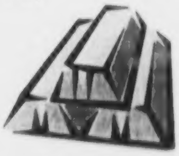
**Expansion/Review Material*

TEACHER OVERVIEW

Students should be encouraged to take everyday situations and translate them into mathematical representations (tables, graphs, diagrams, expressions, or equations) and interpret the results. Direct variation is a major concept in real-life mathematics. The general form of the equation for a direct variation is $y = kx$ where k is the constant of proportionality.

***Vocabulary*:** direct variation, constant of proportionality

ACTIVITY: Every Which Way But Loose (visual, table, graph, equation)



***Purpose*:** To demonstrate direct variations

Materials/Equipment:

Five or more bars of candy, rectangular packages of crackers, or other items that will stack
(The weight should be stated on the package.)
Large grid graph paper for each student (or graphing calculator)
Chalk board or marker board for making a table

***Procedure*:**

1. The teacher starts by stacking the candy in several different ways and asking, "Is the weight of the candy changed by the way it is stacked?" "If we start with one bar and add one at a time, how does the weight change?" (Wait for several comments.)
2. Students then construct a table on the board to show the weight of one, two, three, etc.
3. Each class member will develop a graph showing the information.
4. The teacher asks, "What happens when the number of candy bars is doubled? Halved?" Try to write an equation to cover all possibilities. Say, "The weight varies directly as the number of candy bars varies."
5. Check each student's equation.
6. Use the equation to solve for the weight of 50 bars, one million, etc.

7. Discuss direct variations such as the cost of x gallons of gasoline, payment for babysitting x hours at $4.00 per hour, or annual interest on x dollars at 12% per year. Move to writing equations for direct variations from the text or other material and to using the equations to solve problems.
8. Assign problems for students to work on their own.

Sample Problem:

The weight of an object on the moon varies directly as its weight on Earth. Part of the equipment for the lunar exploration weighed 360 pounds on Earth. On the moon, the equipment weighed 60 pounds. Tom weighs 186 pounds on Earth. What would he weigh on the moon?
Answer: y = *weight on moon*, x = *weight on Earth*

Solution 1

$$y = kx$$

$$60 = k(360)$$

$$\frac{1}{6} = k$$

$$y = kx$$

$$y = \frac{1}{6}(186)$$

$$y = 31 \text{ lbs.}$$

Solution 2

$$y_1 = kx_1 \text{ and } y_2 = kx_2$$

$$\frac{y_1}{x_1} = k \text{ and } \frac{y_2}{x_2} = k$$

$$\text{Therefore, } \frac{y_1}{x_1} = \frac{y_2}{x_2}$$

$$\frac{60}{360} = \frac{y}{186}$$

$$360\,y = 60\,(186)$$

$$360\,y = 11{,}160$$

$$y = 31 \text{ lbs.}$$

Extension:

Use various sizes of circles to show how the circumference of the circle varies directly as the diameter varies.

Reading/Writing Connection:

Reading Comprehension Standard II, Objective 3: Determine cause and effect.
Reading Comprehension Standard IV, Objective 2: Demonstrate the ability to preview and predict.
Reading Comprehension Standard IV, Objective 3: Discern organizational patterns.

Divide the class into pairs of students. Select student pairs that provide the greatest possibility for success by each team. Tell each pair of students to read a direct variation problem and write an equation appropriate for solving the problem. A written description of what is required in the problem and the steps necessary for solving the problem should be provided.

STANDARD VII: **The student will be able to solve problems involving a variety of algebraic and geometric concepts.**

OBJECTIVE 8: **Solve problems involving algebraic concepts.**

ELIGIBLE CONTENT:

- **Word problems will be used.**
- **Interpretation of figures may be required.**
- **The following content may be included:**
  - **Distance-rate-time problems**
  - **money problems, which may require a system of equations**
  - **numbers (sum, difference, product, quotient)**
  - **simple age problems referring only to the present**
  - **consecutive integers**
  - **area, volume, dimension problems**
  - **quantity problems**
  - **cost problems**
  - **wage problems**

NUMBER OF TEST ITEMS: 4

SUBJECT	LOCATION OF OBJECTIVE WITHIN THE COURSE OF STUDY	PAGE
7th Grade Math	49. Solve algebraic problems using calculators and computers when appropriate.	59
8th Grade Math	37. Use linear equations and inequalities to solve problems. 40. Solve algebraic problems using calculators and computers when appropriate.	67 67
Introduction to Algebra	14. Use problem-solving strategies effectively.	75
Algebra I	32. Solve word problems using a variety of methods.	83
***Algebra II with Trig.**	59. Solve problems using a variety of methods.	100

**Expansion/Review Material*

SUBJECT	PREREQUISITE SKILLS OR RELATED SKILLS FOR THIS OBJECTIVE WITHIN THE COURSE OF STUDY	PAGE
5th Grade Math	13. Apply basic operations in problem-solving situations involving whole numbers, decimals, fractions, mixed numbers, and money.	43
	18. Determine and use the most appropriate method of calculation.	44
	19. Apply a variety of strategies to solve problems with an emphasis on multi-step and non-routine problems.	44
6th Grade Math	12. Use basic operations in context.	50
	13. Determine and use the most appropriate method of calculation.	50
	19. Develop and apply a variety of strategies to solve problems with emphasis on multi-step and non-routine problems.	50
7th Grade Math	11. Select and use the most appropriate mode of calculation in any given situation.	55
	13. Demonstrate proficiency in solving consumer-related problems.	56
	15. Use problem-solving strategies effectively.	56
	22. Solve real-life measurement problems.	57
	25. Apply appropriate formulas to find perimeter, circumference, surface area, area, and volume.	57
8th Grade Math	10. Demonstrate proficiency using estimation techniques in problem solving related to real-life situations.	63
	11. Use problem-solving strategies effectively.	63
	23. Apply properties of plane and solid geometric figures to solve problems.	64
	24. Solve problems using relationships between angles	65
Introduction to Algebra	15. Apply properties of plane and solid geometric figures to solve problems.	75
	29. Use scale drawings and geometric models to solve problems.	76
Algebra I	8. Apply the perimeter and area of a polygon to solve problems, given the formulas.	80
	9. Determine the volume and surface area of geometric solids, given the formulas.	81
	10. Solve problems involving the area and circumference of a circle, given the formulas.	81
	26. Solve linear equations.	83

**Expansion/Review Material*

SUBJECT	PREREQUISITE SKILLS OR RELATED SKILLS FOR THIS OBJECTIVE WITHIN THE COURSE OF STUDY (cont.)	PAGE
*Geometry	11. Find the surface area and volume of cylinders, spheres, and prisms, given the formulas. 16. Apply properties and measures associated with triangles and quadrilaterals to solve problems.	89 89
*Algebra II with Trig.	16. Use perimeter, area, and volume formulas to solve word problems. 29. Solve word problems that involve linear or quadratic equations. 52. Solve word problems using trigonometric functions.	95 97 99
*Advanced Mathematics	32. Solve equations.	106
*Mathematics in Society	1. Compute and compare returns on various types of investments using recurrence relations. 3. Determine interest associated with credit cards. 12. Critique and compare automotive acquisition. 13. Apply perimeter, area, and volume formulas in problem solving.	111 111 112 112

**Expansion/Review Material*

TEACHER OVERVIEW

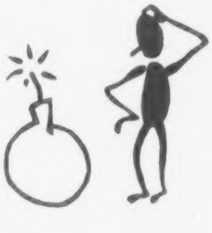
Learning to solve problems is the principal reason for studying mathematics. Problem-solving strategies involve posing questions, analyzing given conditions, using trial and error, drawing diagrams, writing information in different ways, and applying acquired knowledge to new situations. Most texts for Introduction to Algebra or Algebra I suggest using tables as one way to solve word problems.

Vocabulary: algorithm, consecutive integers, sum, difference, product, quotient, dimension

ACTIVITY: Table It

Purpose: To provide students with opportunities to become involved in problem-solving experiences related to a wide variety of situations

Materials/Equipment:



Teacher-prepared worksheets with representative problems based on Standard VII, Objective 8
"Table It" worksheet and transparency (See page C-145.)

Procedure:

1. Students will read problems from the worksheet(s) orally.
2. Discuss the problem. (What kind? What is it asking? What conditions are given? Is there an algorithm for this problem?)
3. The teacher will show all tables on a screen using the overhead projector and ask students to come to the front to fill in information.
4. Group practice should include two or more of each kind of problem.
5. Guided practice should follow before independent practice is assigned. (Teachers should use knowledge about students' abilities to decide how many different kinds of problems can be presented in one lesson.)

Reading/Writing Connection:

Reading Comprehension Standard I, Objective 2: Determine sequence of events.
Reading Comprehension Standard I, Objective 3: Follow directions.
Reading Comprehension Standard II, Objective 2: Draw conclusions.
Reading Comprehension Standard II, Objective 3: Determine cause and effect.
Reading Comprehension Standard IV, Objective 1: Determine word meanings through the use of context clues.
Reading Comprehension Standard IV, Objective 2: Demonstrate the ability to preview and predict.
Reading Comprehension Standard IV, Objective 3: Discern organizational patterns.

Good reading comprehension skills are necessary for students to extract the information needed to solve word problems. Assign two different problems and ask students to compare the steps needed to solve the problems.

ACTIVITY: The Read, Stop, Think, Draw, and Write Method of Problem Solving

Purpose: To introduce students to the read, stop, think, draw, and write method of problem solving

Materials/Equipment:

Worksheet of word problems
Textbook

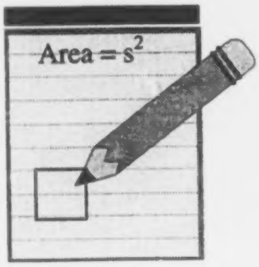
Procedure:

Example problem: The area of a square is equal to the area of a right triangle whose legs measure 4 inches and 8 inches. Find the lengths of the sides of the square.

1. Read the problem slowly and in small phrases to try to understand the meaning.

2. Begin reading. "The area of a square"

- Stop.
- Think about this. What are the main words? What do they mean?
- Draw a picture if possible.



- Write: area □ = s^2

3. Continue reading. "is equal to"
   - Stop.
   - Think.
   - Write: $s^2 =$

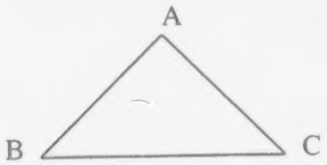
4. Continue reading. "the area of a right triangle"
   - Stop.
   - Think.
   - Write: $s^2 = \frac{1}{2}\ bh$

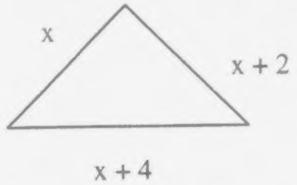
5. Continue reading. "whose legs measure 4 inches and 8 inches."
   - Stop.
   - Think.
   - Write: $s^2 = \frac{1}{2}\ (4)(8)$

     $= 16$ sq. in.
   - Write: $s\ = 4$ inches. The side of the square is 4 inches.

Additional Problems:

1. The lengths of the sides of triangle ABC are consecutive odd integers. The perimeter is 39 inches. What are the lengths of the sides? *(Answer: 11,13,15)*





2. Joan needs a mechanic to repair her car. Since the car is an old model, she does not want to spend more than $500 for repairs. The manager said the computer evaluation of the problem would be $80 and labor would be an additional $40 per hour. If replacement parts are $210, what is the maximum number of hours the repair person can work and keep the total cost at $500? *(Answer: 5 ¼ hours)*

3. On a Sunday afternoon, the Johnson and Alvarez families decided to see a movie. The Johnsons, two adults and four children, only have $30 to spend on entertainment for the week. The Alvarez group, two adults and two children, can afford to spend $21.50. If they attend the movie together, what price can the families pay for adult tickets? *(Answer: $6.50 adult ticket)*

Additional practice problems from a worksheet or textbook can be used to continue practicing this method of problem solving.

***Reading/Writing Connection*:**

Reading Comprehension Standard I, Objective 3: Follow directions.
Reading Comprehension Standard II, Objective 2: Draw conclusions.
Reading Comprehension Standard IV, Objective 1: Determine word meanings through the meaning of context clues.

Have the students write word problems that would utilize this method for problem solving. Share problems with fellow classmates and allow time for students to solve the problems.

TABLE IT

1.

Conditions	Rate	Time	Distance

2.

Conditions	No. of Hours	Rate	Wages

3.

Conditions (Items)	Number	Value of One	Total Value

4.

Conditions (Items)	Number	Unit Price	Total Cost

5.

Geometric Description	Length	Width	Area

6.

Integers	Arithmetic Operation	Equation

7.

Geometric Figure	Length	Width	Height	Volume

D. RESOURCES

Resources

Note: These resources are samples and do not necessarily carry the endorsement of the State Department of Education nor the AHSGE Task Force.

Websites

http://www.alsde.edu
Alabama State Department of Education

http://www.ed.gov
U.S. Department of Education

http://info.lib.uh.edu/wsub.htm

http://www.hq.nasa.gov/education
NASA On-line Resources for Educators

http://spacelink.nasa.gov
NASA On-line Resources for Educators

http://www.nctm.org
National Council of Teachers of Mathematics

http://www.enc.org
Eisenhower National Clearinghouse

http://www.teachnet.org
Technet-The Teacher's Network

http://tristate.pgh.net/~pinch13/index.html
B.J. Pinchbeck's Homework Page

http://www.upland.k12.ca.us/baldyvw/megaw.html
Mr. Megaw's Homework Page

http://www.4teachers.org

http://www.algebra-online.com
Algebra-online

http://www.ira.org
International Reading Association

http://www.pbs.org/mathline/
PBS Mathline

http://forum.swarthmore.edu
(Questions and answers on everything from Algebra to Trigonometry; math lesson plans for middle school or high school)

http://archivees.math.utk.edu/
(Teaching materials and math resources)

http://www.c3.lanl.gov/mega-math/
(Math lesson plans)

http://tqd.advanced.org/2647/main.htm
IMO: Interactive Mathematics On-line
(Topics include Algebra, Geometry, and Trigonometry)

http://www.assiniboinec.mb.ca/user/downes/fallacy/fall.htm
(A great place for Geometry students to visit)

http://www.ebig.com/
Encyclopaedia Britannica, Inc.

http://www.rialto.k12.ca.us/school/frisbie/math7.html
Rialto Unified School District, Grade 7 Math

http://www.yahooligans.com/Science_and_Oddities/Math/
Yahooligans! Directory

http://www.learner.org
Annenberg/CPB Math and Science Collection

http://www.aptv.org
Alabama Public Television

www.cs.uidaho.edu/~casey931/mega-math/index
(Listing of mathematical topics with activities)

www.mste.uiuc.edui591/mathed/completelist.html

www.math.upenn.edu/MathSources.html

www.nosweat.com

Books and Other References

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Assessment Standards for School Mathematics, Prepared by the Assessment Standards Working Groups of the National Council of Teachers of Mathematics, 1906 Association Drive, Reston, VA 22091, 1995.

Basic Algebra, Jurgensen, Brown, Houghton Mifflin, 1990.

Basic Algebra, Jerome D. Kaplin, Ed.D, Educational Design, Inc., 1996.

Connected Mathematics®, G. Lappan, J. Fey, W. Fitzgerald, S. Friel, and E. Phillips, available from Dale Seymour Publications, White Plains, NY.

Curriculum and Evaluation Standards for School Mathematics, Prepared by Working Groups of the National Council of Teachers of Mathematics, 1906 Association Drive, Reston, VA 22091, 1995.

Glencoe Algebra I, Glencoe/McGraw-Hill, New York, 1998.

Key to Algebra – Polynomials, Julie King and Peter Rasmussen, Key Curriculum Press, ISBN 1-55954-9.

Math Games and Activities, Jane O'Connell and Linda Flowers, illustrated by Becky Radtke, Frank Schaffer Publications, Inc., 1993.

Opening the Gate, Algebra for Everyone, funded by the Dwight D. Eisenhower Mathematics and Science Education Act, Title II, through the Florida Department of Education.

Patty Paper Geometry, Michael Serra, Key Curriculum Press, 1994.

"Raising the Bar" (video), Baldwin County Board of Education, 175 Courthouse Square, Bay Minette, AL 36507.

Strengthening Student Achievement and Motivation in Your Math Classes, David R. Johnson, Bureau of Education and Research, 915 118th Avenue SE, Bellevue, WA 98009.

The Ideas of Algebra, K-12, 1988 Yearbook, Arthur F. Coxford, Editor, National Council of Teachers of Mathematics, 1906 Association Drive, Reston, VA 22091, 1990.

The Math Teacher's Books of Lists, Judith A. Muschla and Gary Robert Muschla, Prentice Hall, 1995.

Understanding Math Through Writing and Reading (Grades 5-8), Don Blattner and Myrl Shireman, Mark Twain Media/Carson-Dellosa Publishing Company, Inc., 1997, Printing No. CD-1884.

Writing in Math Class, Marilyn Burns, (Grades 2-8), Math Solutions Publications, 1995, ISBN 0-941355-13-6.

E. ITEM SPECIFICATIONS: MATHEMATICS

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- Objective 3: Solve systems of two linear equations 20
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INTRODUCTION

This bulletin provides specific information about the *Alabama High School Graduation Exam*, Third Edition (AHSGE). Educators representing each state school board district as well as both city and county school systems served on the committees that determined the standards and objectives; determined the eligible content for the test; and reviewed, revised, and approved the actual items.

The standards and objectives for the AHSGE are also found in *Standards and Objectives* (*Reading Comprehension, Language, Mathematics, and Science*) *for the Alabama High School Graduation Exam,* Bulletin 1997, No. 16, and *Standards and Objectives* (*Social Studies*) *for the Alabama High School Graduation Exam,* Bulletin 1998, No. 13. The standards and objectives for mathematics are specifically referenced in this document.

Teachers must be familiar with this document if they teach content that relates to the objectives measured on the graduation exam in the middle grades or in the high school grades. Further, teachers must use this document in focusing instruction for students who have demonstrated weaknesses on objectives measured on the pre-graduation examination and the AHSGE.

An item specification has a distinct purpose and provides essential information concerning the testing of an objective. Item specifications for mathematics will follow this order:

STANDARD	Broad area of content to be assessed
OBJECTIVE	Specific skill within a standard to be assessed
ELIGIBLE CONTENT	Clarification and elaboration of an objective (where applicable)
SAMPLE ITEMS	Item formats to test each objective

The sample items in this bulletin will **not** be found on the pre-graduation examination or the AHSGE. The number of sample items in this bulletin does not necessarily reflect the weight of the content on the test. In order to identify the weight of the content, the following chart shows the number of items for each mathematics objective.

OBJECTIVES		NUMBER OF ITEMS
I-1	Apply order of operations	4
I-2	Add and subtract polynomials	4
I-3	Multiply polynomials	4
I-4	Factor polynomials	4
II-1	Solve multi-step equations	4
II-2	Solve quadratic equations	4
II-3	Solve systems of linear equations	4
II-4	Solve multi-step inequalities	4
III-1	Identify functions	4
III-2	Find the range of functions	4
IV-1	Find perimeter, circumference, area, volume	4
IV-2	Find the distance, midpoint, slope	4
V-1, 4	Graph: Linear Equations; Common Relations	6
V-2	Graph lines given certain conditions	4
V-3	Determine solution sets of inequalities	4
VI-1	Translate: Verbal or Symbolic Graph: Equations or Inequalities	6
VII-1	Apply properties and relationships between angles	4
VII-2	Apply Pythagorean Theorem	4
VII-3	Apply properties of similar polygons	4
VII-4	Apply properties of geometric figures	4
VII-5	Determine measures of central tendency	4
VII-6	Determine probabilities	4
VII-7	Solve problems: Direct Variation	4
VII-8	Solve problems: Algebraic Concepts	4
TOTAL		100

The content of the mathematics subject-area test is approximately 75% Algebra I and 25% pre-geometry.

A calculator will be provided for each student although a calculator is not needed in order to solve the problems. The state-provided calculator is a four-function calculator with additional percent, +/–, and square root keys. Each key performs a single function. The calculator must be returned to the Test Administrator after the student has completed the test. Therefore, each student is provided with the opportunity to practice using the state-provided calculator during the week prior to testing. Each student will be provided a Calculator Practice Booklet and a teacher will instruct the student on how to use the calculator.

Each test booklet contains a reference page of formulas for use during the test. The reference page from the test booklet must be returned to the Test Administrator after the student has completed the test. Therefore, a copy of the reference page is included in this bulletin which can be duplicated as needed.

REFERENCE PAGE

Use the information below to answer questions on the Alabama High School Graduation Exam.

Some Abbreviations Used in Formulas

b_1, b_2 = bases of a trapezoid
b = base of a polygon
h = height or altitude
l = length
w = width
∟ symbol for a right angle
$m\angle$ = the measure of an angle

A = area
C = circumference
r = radius
d = diameter
π = 3.14
P = perimeter
D = distance
M = midpoint
m = slope

S.A. = surface area
V = volume
B = area of the base
S = sum of interior angles of a convex polygon
n = number of sides of a convex polygon

Formulas

Triangle: $\mathbf{A} = \frac{1}{2}\mathbf{bh}$

Parallelogram: $\mathbf{A} = \mathbf{bh}$

Rectangle: $\mathbf{A} = \mathbf{lw}$

Trapezoid: $\mathbf{A} = \frac{1}{2}\mathbf{h}(\mathbf{b}_1 + \mathbf{b}_2)$

Circle: $\mathbf{C} = \pi\mathbf{d}$
$\mathbf{C} = 2\pi\mathbf{r}$
$\mathbf{A} = \pi\mathbf{r}^2$

Distance = rate • time

Interest = principal • rate • time

Distance Formula: $\mathbf{D} = \sqrt{(x_2 - x_1)^2 + (y_2 - y_1)^2}$

Midpoint Formula: $\mathbf{M} = \left(\frac{x_1 + x_2}{2}, \frac{y_1 + y_2}{2}\right)$

Slope Formula: $\mathbf{m} = \frac{y_2 - y_1}{x_2 - x_1}$

Sum of Measures of Interior Angles of a Convex Polygon: $\mathbf{S} = 180(\mathbf{n} - 2)$

Quadratic Formula: $x = \frac{-\mathbf{b} \pm \sqrt{\mathbf{b}^2 - 4\mathbf{ac}}}{2\mathbf{a}}$

Pythagorean Theorem: $\mathbf{c}^2 = \mathbf{a}^2 + \mathbf{b}^2$

	Surface Area	Volume
Rectangular Prism	$\mathbf{S.A.} = \mathbf{Ph} + 2\mathbf{B}$ or $\mathbf{S.A.} = 2(\mathbf{wh} + \mathbf{lh} + \mathbf{lw})$	$\mathbf{V} = \mathbf{Bh}$ or $\mathbf{V} = \mathbf{lwh}$
Cylinder	$\mathbf{S.A.} = 2\pi\mathbf{rh} + 2\pi\mathbf{r}^2$	$\mathbf{V} = \pi\mathbf{r}^2\mathbf{h}$

Forms of Equations

Standard form of an equation of a line: $Ax + By = C$

Slope-intercept form of an equation of a line: $y = \mathbf{m}x + b$

Point-slope form of an equation of a line: $y - y_1 = \mathbf{m}(x - x_1)$

ITEMS

BY

STANDARD AND OBJECTIVE

STANDARD I: The student will be able to perform basic operations on algebraic expressions.

OBJECTIVE

1. Apply order of operations.

ELIGIBLE CONTENT

- One, two, or no variables may be used.
- One set of parentheses may be used.
- Determining the absolute value of a term may be required.
- Squaring the quantity in parentheses may be required.
- No more than four terms may be included.
- Adding or subtracting negative integers may be required.
- Decimals to the tenths' place may be used.

SAMPLE ITEMS

1 Simplify: $(3+2)^2 + 1 - 3^2 \bullet 5$

***A** $^{-}19$

B $^{-}4$

C 71

D 85

2 Simplify: $x - y - (x - 2y)$

***A** y

B $^{-}3y$

C $x + 3y$

D $2x - 3y$

3 Simplify: $5 \bullet 4^2 \div 8 + (2^3 - 7)$

A $^{-}5$

B 4

C 9

***D** 11

4 Simplify: $2x + \dfrac{10x + 4x}{2}$

A $8x$

***B** $9x$

C $11x$

D $14x$

5 Simplify: $6.4 - |14.7 + 0.5|$

A -7.8

B 8.8

* **C** -8.8

D 21.6

STANDARD I: The student will be able to perform basic operations on algebraic expressions.

OBJECTIVE

2. Add and subtract polynomials.

ELIGIBLE CONTENT

- Using the distributive property may be required.
- Unlike denominators may be used.

SAMPLE ITEMS

1 Simplify: $15x^2 + xy - 9x^2 - 3xy$

* **A** $6x^2 - 2xy$

B $6x^4 - 2x^2y^2$

C $24x^2 - 4xy$

D $24x^4 - 4x^2y^2$

2 Simplify: $2(t^2 + 5) - 3(t^2 + 5)$

A $t^2 + 5$

* **B** $-t^2 - 5$

C $-t^2 + 10$

D $-t^2 + 25$

3 Simplify: $2.5x^2 - 7.5 + 0.5x^2 + 2$

A $3x^2 + 1$

* **B** $3x^2 - 5.5$

C $3x^2 - 5$

D $6x^2 + 1$

4 Simplify: $\frac{2x+1}{2} + \frac{12x+3}{6}$

* **A** $3x + 1$

B $3x + 4$

C $14x + 1$

D $14x + 4$

5 Simplify: $\frac{1}{3}x + \frac{1}{3}y + 4(\frac{1}{6}x + \frac{1}{4}y)$

A $x + \frac{2}{3}y$

* **B** $x + \frac{4}{3}y$

C $\frac{1}{2}x + \frac{4}{3}y$

D $x + \frac{1}{3}y$

STANDARD I: The student will be able to perform basic operations on algebraic expressions.

OBJECTIVE

3. Multiply polynomials.

ELIGIBLE CONTENT

- Multiplying two quantities in parentheses may be required.
- Squaring a quantity in parentheses may be required.
- Adding or subtracting may be required.
- Raising a quantity to a power may be required.
- Fractions may be used.
- Adding exponents may be required.

SAMPLE ITEMS

1 Simplify: $\frac{3y}{2} \bullet \frac{2y}{3}$

A $\frac{4}{9}$

B $\frac{9}{4}$

C y

* **D** y^2

2 Simplify: $(4x)(2y) - (3x)(-y)$

A $5xy$

* **B** $11xy$

C $24x^2y^2$

D $x - y$

3 Simplify: $(4x+3)(3x-2)$

A $12x^2 + x + 6$

B $12x^2 - 6$

C $12x^2 - 6x - 6$

* **D** $12x^2 + x - 6$

4 Simplify: $(x-4)(x+4)$

A x^2

B $x^2 + 8x + 16$

C $x^2 - 8x - 16$

* **D** $x^2 - 16$

5 Simplify: $\left[\frac{4x+3}{5}\right]^2$

A $\frac{16x^2+9}{25}$

* B $\frac{16x^2+24x+9}{25}$

C $\frac{4x^2+3}{5}$

D $\frac{4x^2+7x+3}{5}$

6 Simplify: $(x-6)(x-9)$

* A $x^2-15x+54$

B $x^2+15x-54$

C $x^2+15x+54$

D $x^2-15x-54$

7 Simplify $3x^2(3x)^2$

A $9x^2$

B $18x^4$

C $27x^2$

* D $27x^4$

8 Which of these is equivalent to $(x^2y)^3$?

A x^2y^3

B x^5y^3

C x^5y^4

* D x^6y^3

STANDARD I: The student will be able to perform basic operations on algebraic expressions.

OBJECTIVE

4. Factor polynomials.

ELIGIBLE CONTENT

- The following factoring may be required:
  - difference of two squares
  - greatest common monomial
  - trinomial
  - common binomial
- Options will be factored completely.

SAMPLE ITEMS

1 Factor: $9x^2 - 9$

A $9(x-1)$

B $9(x-1)^2$

C $3(x+3)(3x-1)$

* D $9(x+1)(x-1)$

2 Factor: $4x(x+1)+(x+1)$

A $4x(x+1)$

B $4x(x+1)^2$

* C $(4x+1)(x+1)$

D $(4x+1)(x+1)^2$

3 Factor: $2m^3 - 10m^2 + 8m$

A $2m(m+2)(m+2)$

B $2m(m-2)(m-2)$

C $2m(m+4)(m+1)$

* D $2m(m-4)(m-1)$

4 Factor: $x^2 - x - 2$

* A $(x+1)(x-2)$

B $(x-1)(x-2)$

C $(x+1)(x+2)$

D $(x-1)(x+2)$

5 Factor: $2x^2 - 5x - 12$

A $(x+6)(x-2)$

B $(2x-1)(x-12)$

* **C** $(2x+3)(x-4)$

D $(2x-3)(x+4)$

6 Factor: $81a^4 - 16$

A $(9a^2+4)(9a^2+4)$

* **B** $(9a^2+4)(3a-2)(3a+2)$

C $(3a+2)(3a+2)(3a-2)(3a-2)$

D $(3a-2)(3a-2)(3a-2)(3a-2)$

7 What is the greatest common factor of $24xy^2$ and $16x^2y$?

A $4xy$

* **B** $8xy$

C $2x^2y^2$

D $8x^2y^2$

STANDARD II: The student will be able to solve equations and inequalities.

OBJECTIVE

1. Solve multi-step equations of first degree.

ELIGIBLE CONTENT

- One set of parentheses may be used.
- Finding the sum or difference of terms containing the same variable may be required.
- Adding or subtracting a variable to or from both sides of the equation may be required.
- The solution to the equation may be a fraction.
- Coefficients may be simple fractions.

SAMPLE ITEMS

1 Solve: $^-2x - 7 = {}^-x + 13$

* **A** $^-20$

B $^-6$

C $^-2$

D 20

2 Solve: $\frac{2x+1}{3} = 5$

A 2

B 6

* **C** 7

D 8

3 Solve: $\frac{x}{3} = \frac{x-6}{4}$

* **A** $^-18$

B $^-6$

C 6

D 24

4 Solve: $2(^-x + 3) = 14$

A $^-10$

B $-\frac{11}{2}$

* **C** $^-4$

D 4

5 Solve: $4x+1=7$

A $\frac{7}{5}$

* **B** $\frac{3}{2}$

C 2

D 24

STANDARD II: The student will be able to solve equations and inequalities.

OBJECTIVE

2. Solve quadratic equations that are factorable.

ELIGIBLE CONTENT

- Factoring of the type $ax^2 + bx = 0$ may be required.
- The following factoring may be required:
    - difference of two squares
    - greatest common monomial
    - trinomial
    - common binomial

SAMPLE ITEMS

1 Solve: $16x^2 - 1 = 0$

***A** $\frac{1}{4}, -\frac{1}{4}$

B $\frac{1}{16}, -\frac{1}{16}$

C $4, -4$

D $16, -16$

2 Solve: $3x^2 - 2x - 5 = 0$

***A** $\frac{5}{3}, -1$

B $\frac{3}{5}, -1$

C $\frac{5}{3}, 1$

D $-\frac{5}{3}, 1$

3 Solve: $4x(x+1) - (x+1) = 0$

A $0, \frac{1}{4}$

B $1, \frac{1}{4}$

C $-1, 0$

***D** $-1, \frac{1}{4}$

4 Solve: $3x^2 - 9x = 0$

A $3, 9$

B $0, -3$

***C** $0, 3$

D $0, 9$

5 Solve: $5x^2 - 12 = 11x$

* **A** $-\frac{4}{5}, 3$

B $\frac{4}{5}, -3$

C $-\frac{6}{5}, 2$

D $\frac{6}{5}, -2$

STANDARD II: The student will be able to solve equations and inequalities.

OBJECTIVE

3. Solve systems of two linear equations.

ELIGIBLE CONTENT

- Solving for the values of both x and y may be required.
- The options may be four graphs with lines plotted and the intersection point labeled with its ordered pair.

SAMPLE ITEMS

1 What is the solution of the following system of linear equations?

$4x + 3y = 5$

$^-3x - 6y = 0$

A $(^-1, 2)$

B $(1, ^-2)$

* **C** $(2, ^-1)$

D $(2, 1)$

2 What is the solution of the following system of linear equations?

$y = 3x$

$2x + y = 15$

A $(0, 15)$

* **B** $(3, 9)$

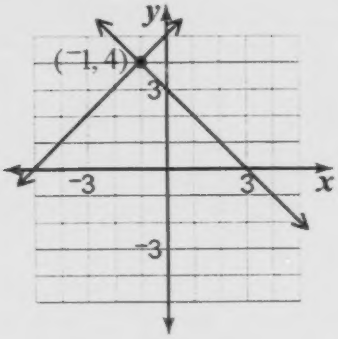
C $(5, 5)$

D $(15, 45)$

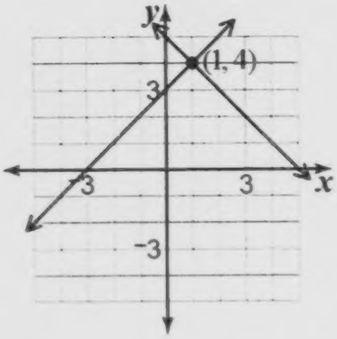
3 Which of these graphs could be used to find the solution for the following system of equations?

$x + y = 3$
$y = x + 5$

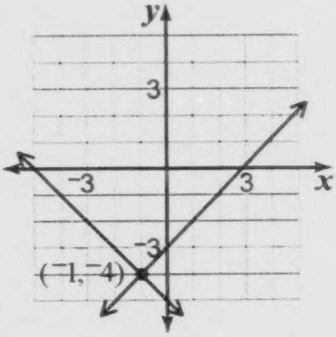
* A



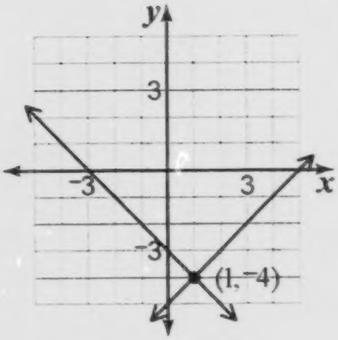
B



C



D



STANDARD II: The student will be able to solve equations and inequalities.

OBJECTIVE

4. Solve multi-step inequalities of first degree.

ELIGIBLE CONTENT

- A negative coefficient may be used.

SAMPLE ITEMS

1 Solve: $3k - 7(k + 5) - 5 < 0$

A $k < {}^{-}10$
*B $k > {}^{-}10$
C $k < 0$
D $k > 0$

2 Solve: $\frac{2}{3}x \geq {}^{-}4$

A $x \geq {}^{-}\frac{8}{3}$
B $x \leq {}^{-}\frac{8}{3}$
*C $x \geq {}^{-}6$
D $x \leq {}^{-}6$

3 Solve: $3x + 5 < x - 3$

*A $x < {}^{-}4$
B $x > {}^{-}4$
C $x < 1$
D $x > 1$

4 Solve: $4(x - 2) \geq {}^{-}2(3 - 3x)$

A $x \geq {}^{-}1$
*B $x \leq {}^{-}1$
C $x \geq 1$
D $x \leq 1$

STANDARD III: The student will be able to apply concepts related to functions.

OBJECTIVE

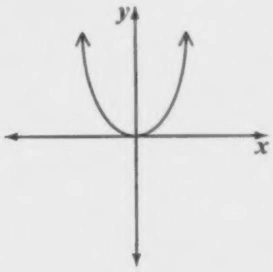
1. Identify functions.

ELIGIBLE CONTENT

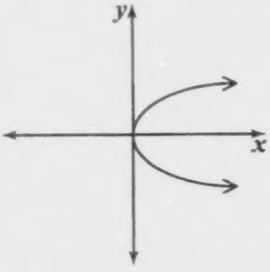
- The options may be graphs, ordered pairs, tables, or mappings.
- The options may be equations when given a table of values or ordered pairs.
- The options may be tables of values or ordered pairs when given an equation.
- Functions may be expressed using either the terminology "$f(x) =$ " or "$y =$ ".

SAMPLE ITEMS

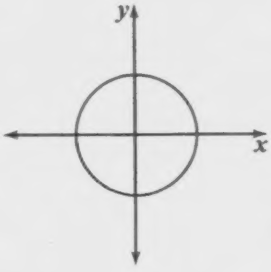
1 Which of these graphs represents a function?



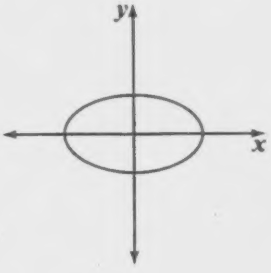
* A



B

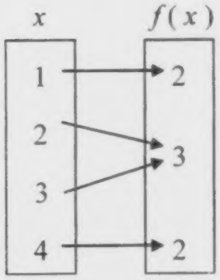


C

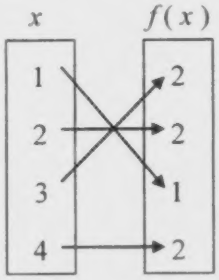


D

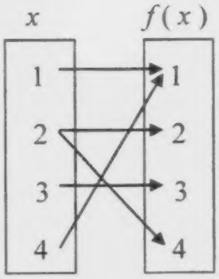
2 Which of these mappings is NOT a function?


x
f(x)
1
2
3
4
2
3
2

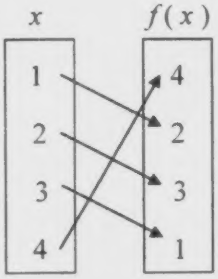
A


x
f(x)
1
2
3
4
2
2
1
2

B


x
f(x)
1
2
3
4
1
2
3
4

* C


x
f(x)
1
2
3
4
4
2
3
1

D

3 Which of these equations represents the data in the table?

x	y
1	$^{-}1$
2	$^{-}5$
$^{-}2$	11

A $y = {}^{-}4x + 1$

***B** $y = {}^{-}4x + 3$

C $y = {}^{-}2x - 5$

D $y = {}^{-}2x + 11$

4 Which of these tables represents the function $y = {}^{-}3x - 5$?

x	y
0	$^{-}8$
1	2
-1	$^{-}2$

A

x	y
1	$^{-}2$
2	$^{-}11$
$^{-}2$	1

B

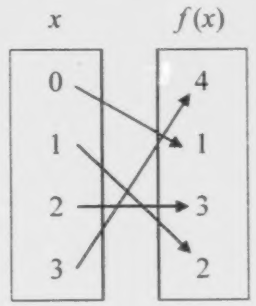
x	y
0	$^{-}5$
1	$^{-}8$
-1	$^{-}8$

C

x	y
0	$^{-}5$
1	$^{-}8$
-1	$^{-}2$

***D**

5 Which of these functions describes the mapping below?



* **A** $f(x)=x+1$

B $f(x)=x-1$

C $f(x)=2x+1$

D $f(x)=2x-1$

6 Which of these tables represents the function $f(x)=|x|+1$?

x	$f(x)$
−2	−3
−1	−2
0	−1
1	0

A

x	$f(x)$
−2	−1
−1	0
0	1
1	2

B

x	$f(x)$
−2	3
−1	2
0	1
1	0

C

x	$f(x)$
−2	3
−1	2
0	1
1	2

* **D**

7 Which of the following relations describes a function?

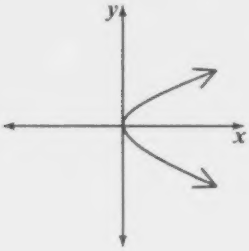
A $\{(-1,3),(3,6),(2,5),(3,9)\}$

B $\{(14,44),(13,44),(13,35),(17,69)\}$

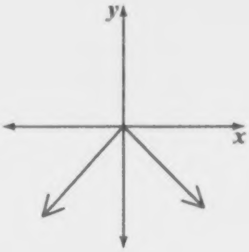
* **C** $\{(6,13),(5,5),(7,16),(3,13)\}$

D $\{(18,18),(15,20),(18,19),(3,9)\}$

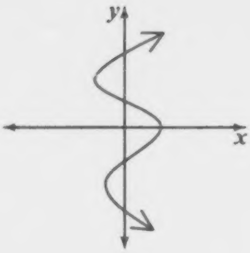
8 Which of these graphs represents a function?



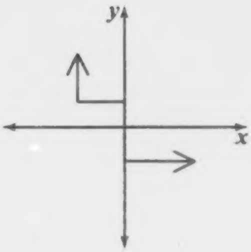
A



* B

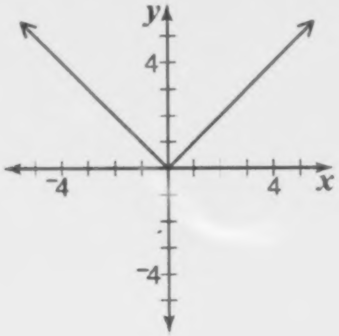


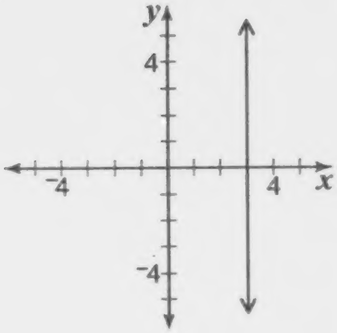
C

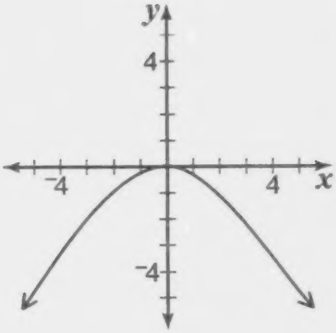


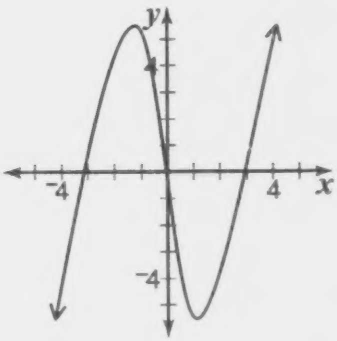
D

9 Which of these graphs does NOT represent a function?

A


* B


C


D


STANDARD III: The student will be able to apply concepts related to functions.

OBJECTIVE

2. Find the range of functions when given the domain.

ELIGIBLE CONTENT

- The domain of a function may be a single value or a set of values.
- A set of ordered pairs may be used.
- Functions may be expressed using either the terminology "$f(x) =$" or "$y =$".

SAMPLE ITEMS

1 What is the range of this function?

$\{(^-3, 4), (0, 0), (1, ^-2), (3, 2)\}$

A $\{^-2, 4\}$

B $\{^-3, 3\}$

* **C** $\{^-2, 0, 2, 4\}$

D $\{^-3, 0, 1, 3\}$

2 What is the range of $y = 3x^2 - 5$ if the domain is $\{^-2, 0, 1\}$?

A $\{2, 0, ^-1\}$

B $\{2, 3, 5\}$

C $\{4, 0, 1\}$

* **D** $\{7, ^-5, ^-2\}$

3 If $f(x) = -x^2 + 2x - 3$, what is $f(4)$?

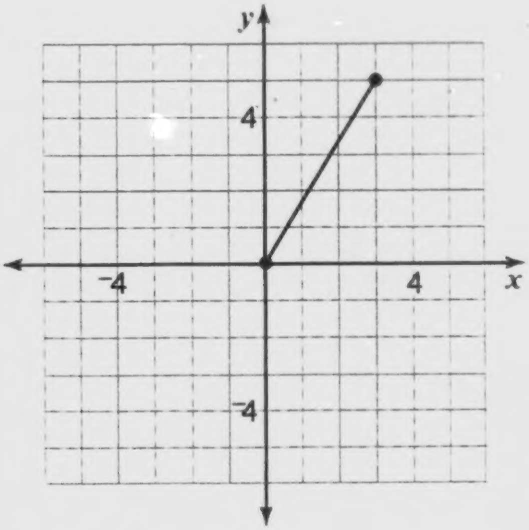
* **A** $^-11$

B $^-3$

C 13

D 21

4 What is the range of the function shown on the graph?



A $3 \leq y \leq 5$

B $2 \leq y \leq 5$

C $0 \leq y \leq 3$

***D** $0 \leq y \leq 5$

STANDARD IV: The student will be able to apply formulas.

OBJECTIVE

1. Find the perimeter, circumference, area, or volume of geometric figures.

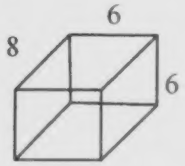
ELIGIBLE CONTENT

- The value of pi (π) will be 3.14.
- Options may be left in terms of π.
- Unnecessary dimensions may be included.
- Drawings may be used.
- Finding volume or surface area of a rectangular prism may be required.
- Extracting a square root may be required.
- Determining the area of a circle when given the diameter in the drawing may be required.
- The formulas will be given in the problems.

SAMPLE ITEMS

1 What is the total surface area of the rectangular prism shown below?

Use $SA = 2(wh + lh + lw)$.



A 80

B 132

* **C** 264

D 288

2 The dimensions of a new football field are 55 yards by 120 yards. Three inches of topsoil will be added to the field. What is the volume of topsoil needed to cover the field?

Use $V = lwh$.

A 275 cubic yards

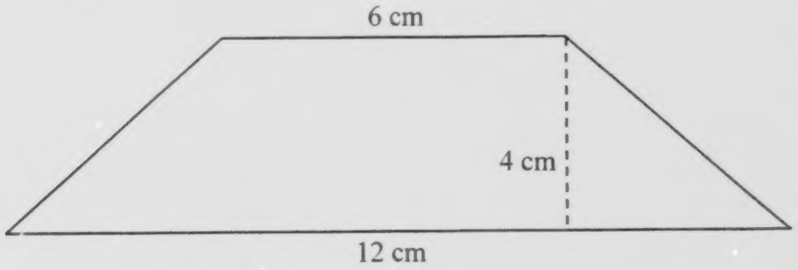
* **B** 550 cubic yards

C 13,200 cubic yards

D 19,800 cubic yards

3 What is the area of this figure?

Use $A = \frac{1}{2}h(b_1 + b_2)$.



A 18 square centimeters

B 24 square centimeters

* **C** 36 square centimeters

D 48 square centimeters

4 A painter was hired to paint a fence. The total length of the fence is 50 feet. Each board is 8 feet tall, $\frac{1}{2}$ foot wide, and $\frac{1}{10}$ foot thick. Only one side of the fence is going to be painted. What is the area of the part of the fence that will be painted?

Use $A = lw$.

A 20 square feet

B 40 square feet

C 200 square feet

* **D** 400 square feet

5 If a circular pool has a diameter of 20 feet, what is the area of the pool to the nearest square foot?

Use $A = \pi r^2$ and $\pi = 3.14$.

A 31 square feet

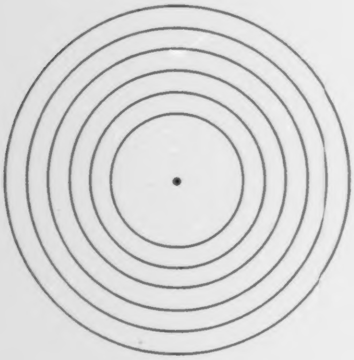
B 63 square fee

* **C** 314 square feet

D 1256 square feet

6 A target has a center circle with a three-inch radius and five outer rings. Each ring is one inch wide. What is the circumference of the largest circle?

Use $C = 2\pi r$.



A 6π inches

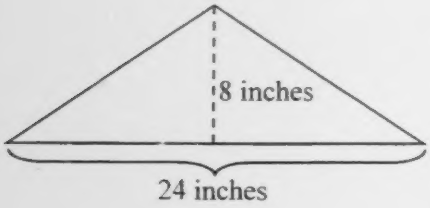
B 11π inches

* **C** 16π inches

D 18π inches

7 What is the area of the triangle shown in the diagram below?

Use $A = \frac{1}{2}bh$.



A 48 square inches

* **B** 96 square inches

C 192 square inches

D 384 square inches

STANDARD IV: The student will be able to apply formulas.

OBJECTIVE

2. Find the distance, midpoint, or slope of line segments when given two points.

ELIGIBLE CONTENT

- Radicals may be used.
- Radicals will be simplified.
- Lines graphed on the coordinate plane may be included.
- Determining the slope of a line given a line on the coordinate plane with two points labeled with their ordered pairs may be required.
- Determining the slope of a line or midpoint of a line segment given two points on a line on the coordinate plane without any coordinates labeled may be required.
- The formulas will be given in the problems.

SAMPLE ITEMS

1 The endpoints of $\overline{AB}$ are $(2, 5)$ and $(^{-}6, 9)$. What are the coordinates of the midpoint of $\overline{AB}$?

Midpoint formula: $M = \left(\frac{x_1 + x_2}{2}, \frac{y_1 + y_2}{2}\right)$

A $(^{-}4, 2)$

* **B** $(^{-}2, 7)$

C $(4, 7)$

D $(7, ^{-}2)$

2 What is the distance between $(4, ^{-}2)$ and $(4, ^{-}8)$?

Distance formula:
$D = \sqrt{(x_2 - x_1)^2 + (y_2 - y_1)^2}$

A $\sqrt{6}$

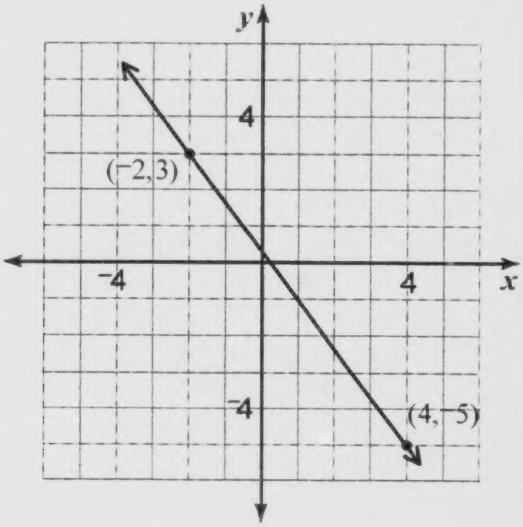
B $2\sqrt{5}$

* **C** 6

D 10

3 What is the slope of the line shown in the graph?

Slope formula: $m = \frac{y_2 - y_1}{x_2 - x_1}$



A -4

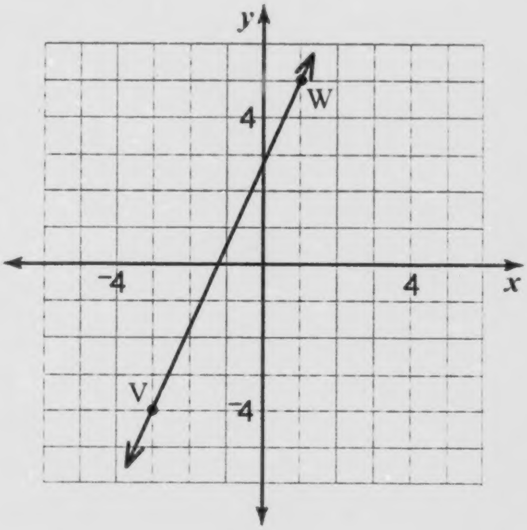
B -1

* **C** $-\frac{4}{3}$

D $-\frac{1}{3}$

4 What is the midpoint of segment VW shown in the graph?

Midpoint formula: $M = \left(\frac{x_1 + x_2}{2}, \frac{y_1 + y_2}{2}\right)$



A $\left(-\frac{7}{3}, 3\right)$

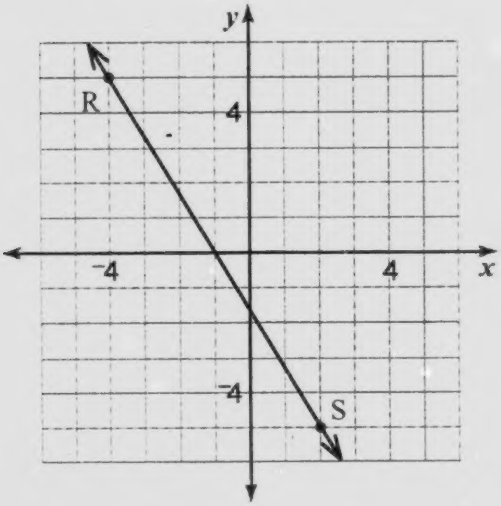
* **B** $\left(-1, \frac{1}{2}\right)$

C $\left(\frac{1}{2}, -1\right)$

D $\left(3, -\frac{7}{2}\right)$

5 What is the length of segment RS shown in the graph below?

Distance formula:
$D = \sqrt{(x_2 - x_1)^2 + (y_2 - y_1)^2}$



A $2\sqrt{26}$

* **B** $2\sqrt{34}$

C 11

D 12

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STANDARD V: The student will be able to apply graphing techniques.

OBJECTIVE

1. Graph or identify graphs of linear equations.
4. Identify graphs of common relations.

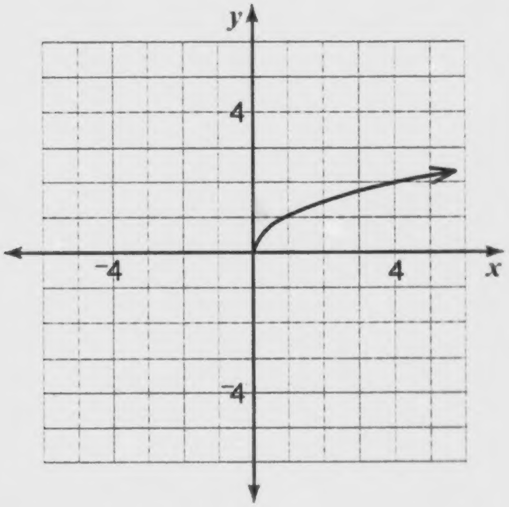
ELIGIBLE CONTENT

- Equations may be expressed in terms of $f(x)$.
- The options may be four graphs.
- The options may be four equations.
- The common relations are:
    - $x = \text{constant}$
    - $y = \text{constant}$
    - $y = x$
    - $y = \sqrt{x}$
    - $y = x^2$
    - $y = |x|$

SAMPLE ITEMS

Sample items begin on next page.

1 Which of these equations represents the graph below?



A $y = x$

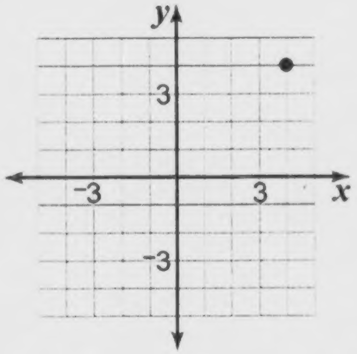
B $y = x^2$

*C $y = \sqrt{x}$

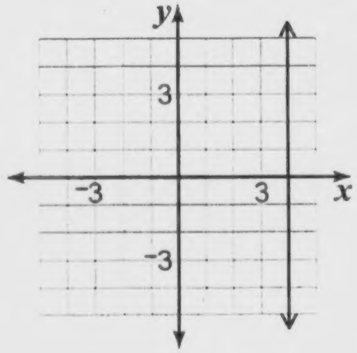
D $y = |x|$

2 Which of these graphs represents the equation $y = 4$?

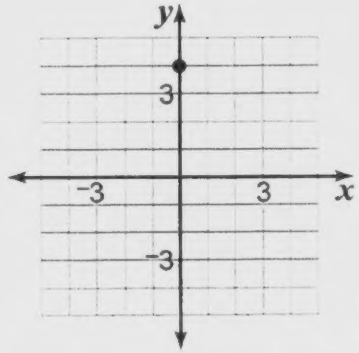
A



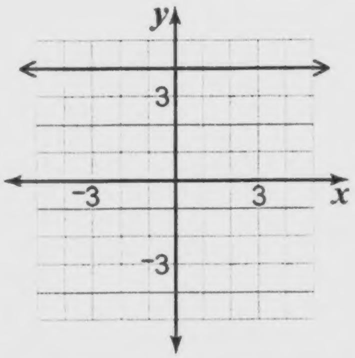
B



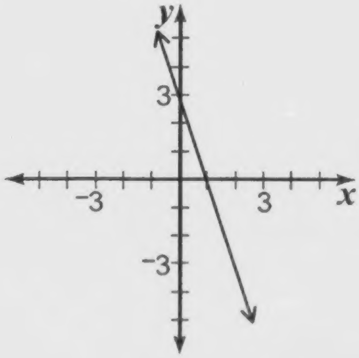
C

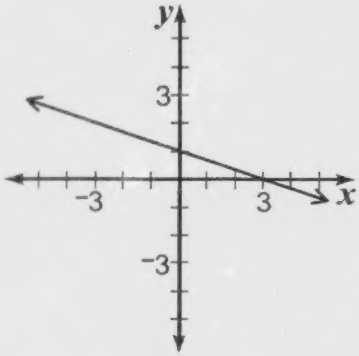


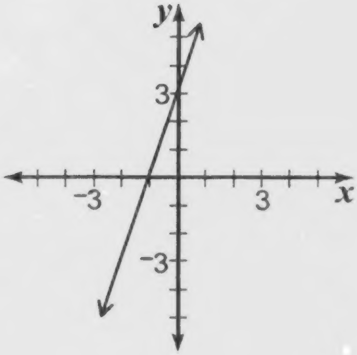
*D

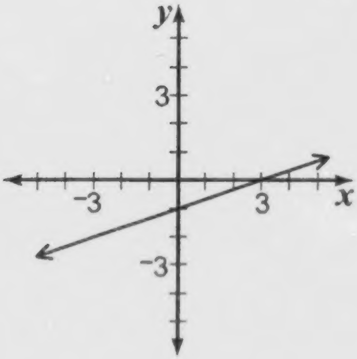


3 Which of these graphs represents the equation $f(x) = 3x + 3$?

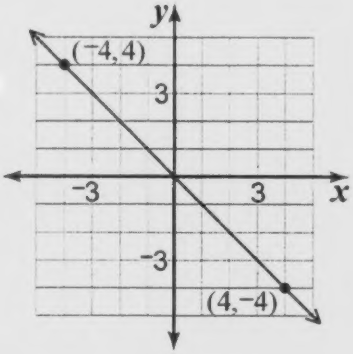
A


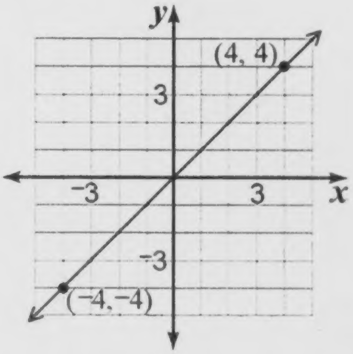
B


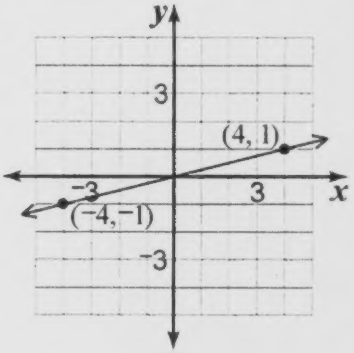
* C


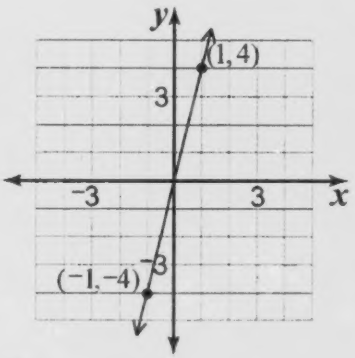
D


4 Which of these graphs represents the equation $2y = \frac{1}{2}x$?

A


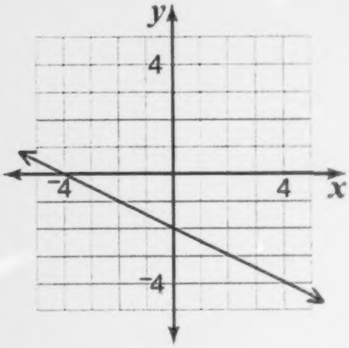
B


* C


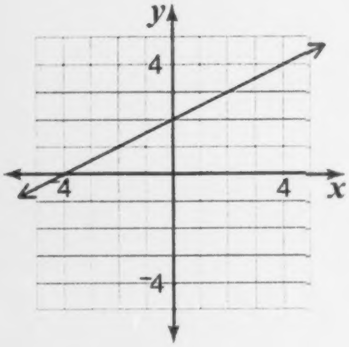
D


5 Which of these graphs represents the equation $y = {}^{-}\frac{1}{2}x + 2$?

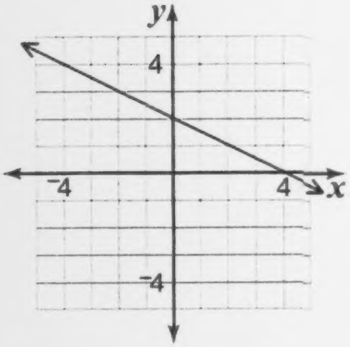
A



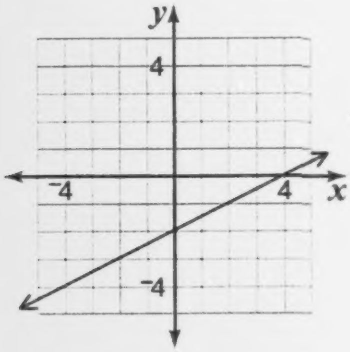
B



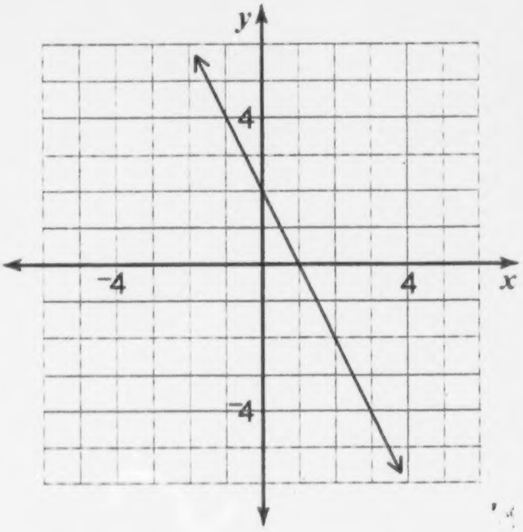
* C



D



6 What is the equation of the line shown in the graph below?



A $y = 2x + 2$

B $y = {}^{-}\frac{1}{2}x + 2$

* **C** $y = {}^{-}2x + 2$

D $y = \frac{1}{2}x + 2$

STANDARD V: The student will be able to apply graphing techniques.

OBJECTIVE

2. Graph lines given certain conditions.

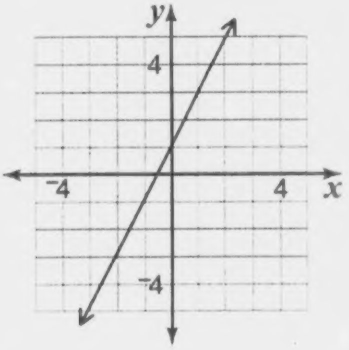
ELIGIBLE CONTENT

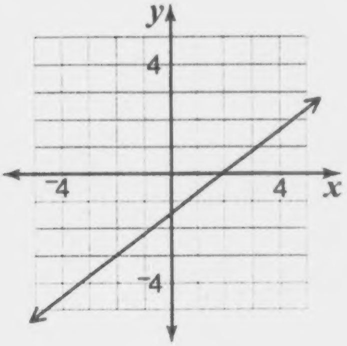
- The following conditions may be included:
    - two points
    - x- and y-intercepts
    - point and slope
    - slope and y-intercept

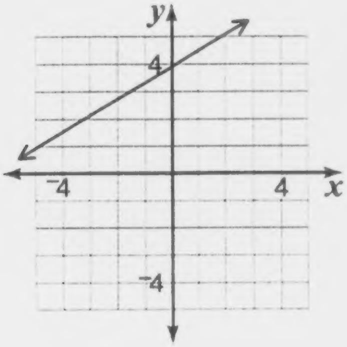
SAMPLE ITEMS

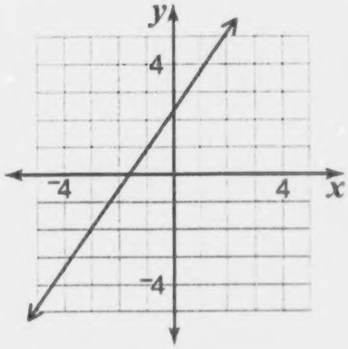
Sample items begin on next page.

1 Which of these graphs represents a line passing through the points $(2, 5)$ and $(^{-}3, ^{-}2)$?

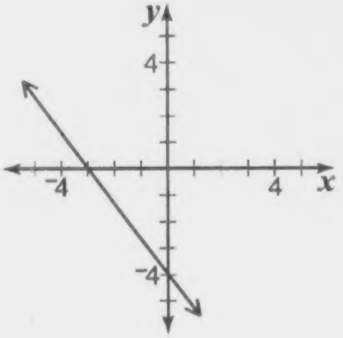
A


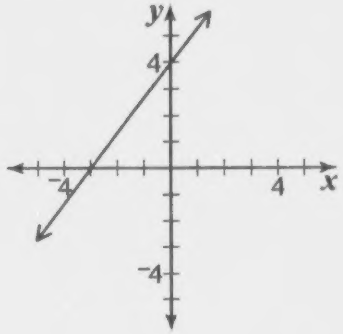
B


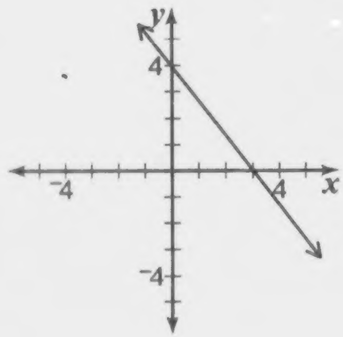
C


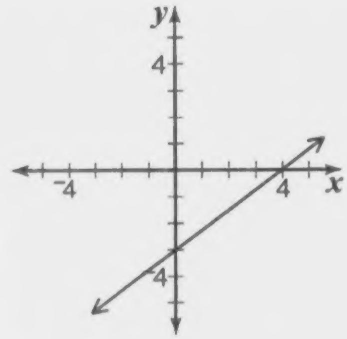
* D


2 Which of these graphs represents a line with x-intercept of $^{-}3$ and y-intercept of 4?

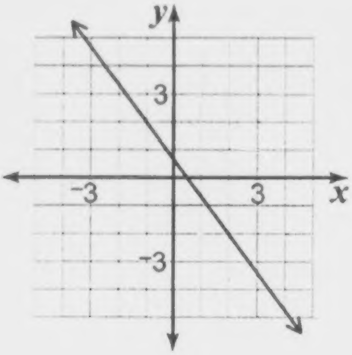
A


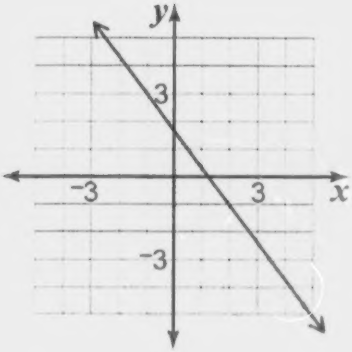
* B


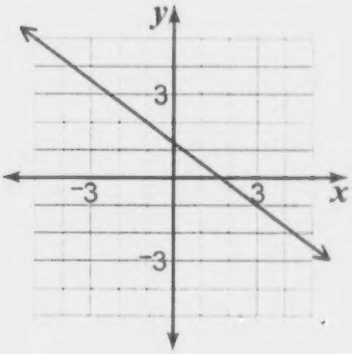
C


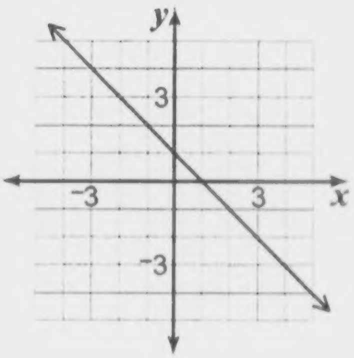
D


3 Which of these graphs represents a line that has a slope of $^{-}\frac{3}{4}$ and passes through $(^{-}1,\ 2)$?

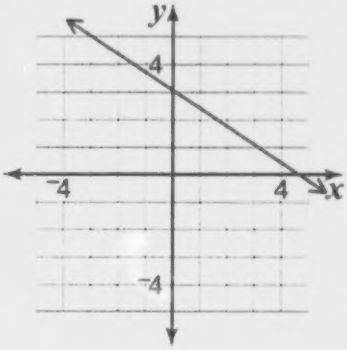
A


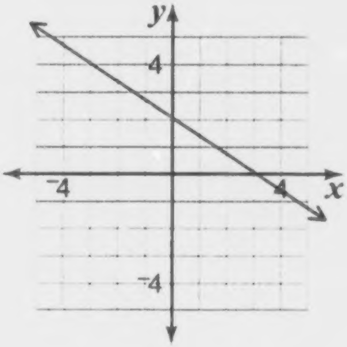
B


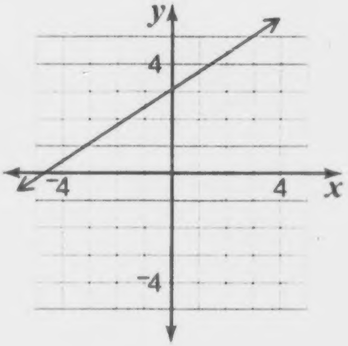
* C


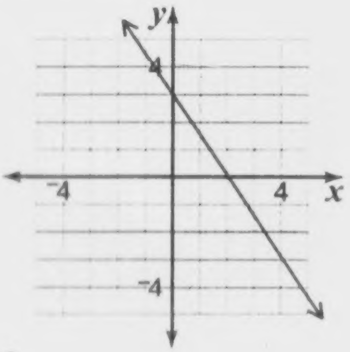
D


4 Which of these graphs represents a line with a slope of $^{-}\frac{2}{3}$ and a y-intercept of 3?

* A


B


C


D


STANDARD V: The student will be able to apply graphing techniques.

OBJECTIVE

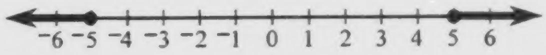
3. Determine solution sets of inequalities.

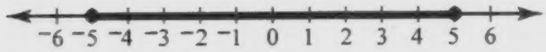
ELIGIBLE CONTENT

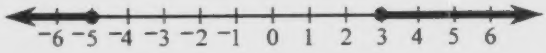
- Compound inequality may be included.
- Solving inequality may be required.
- Options will be graphs.

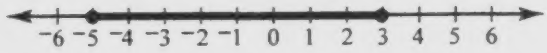
SAMPLE ITEMS

1 Which of these graphs represents the solution of $5 \geq x + 2 \geq {}^{-}3$?

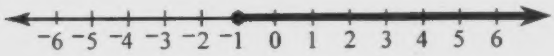
A

−6 −5 −4 −3 −2 −1 0 1 2 3 4 5 6

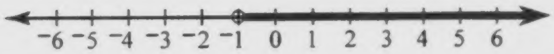
B

−6 −5 −4 −3 −2 −1 0 1 2 3 4 5 6

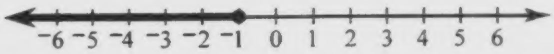
C

−6 −5 −4 −3 −2 −1 0 1 2 3 4 5 6

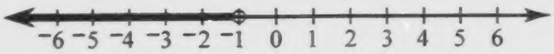
* D

−6 −5 −4 −3 −2 −1 0 1 2 3 4 5 6

2 Which of these graphs represents the solution of $x > {}^{-}1$?

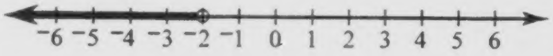
A

−6 −5 −4 −3 −2 −1 0 1 2 3 4 5 6

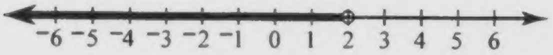
* B

−6 −5 −4 −3 −2 −1 0 1 2 3 4 5 6

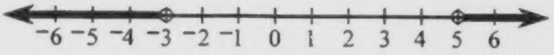
C

−6 −5 −4 −3 −2 −1 0 1 2 3 4 5 6

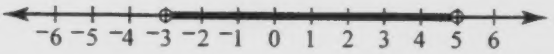
D

−6 −5 −4 −3 −2 −1 0 1 2 3 4 5 6

3 Which of these graphs represents the solution of $^-3 < x < 5$?

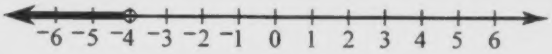
A 
⁻6 ⁻5 ⁻4 ⁻3 ⁻2 ⁻1 0 1 2 3 4 5 6

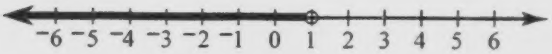
B 
⁻6 ⁻5 ⁻4 ⁻3 ⁻2 ⁻1 0 1 2 3 4 5 6

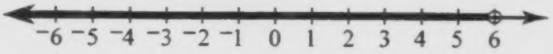
C 
⁻6 ⁻5 ⁻4 ⁻3 ⁻2 ⁻1 0 1 2 3 4 5 6

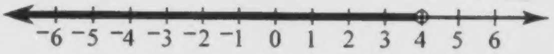
* D 
⁻6 ⁻5 ⁻4 ⁻3 ⁻2 ⁻1 0 1 2 3 4 5 6

4 Which of these graphs represents the solution of $x + 5 < 1$?

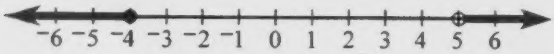
* A 
⁻6 ⁻5 ⁻4 ⁻3 ⁻2 ⁻1 0 1 2 3 4 5 6

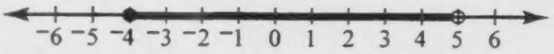
B 
⁻6 ⁻5 ⁻4 ⁻3 ⁻2 ⁻1 0 1 2 3 4 5 6

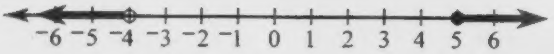
C 
⁻6 ⁻5 ⁻4 ⁻3 ⁻2 ⁻1 0 1 2 3 4 5 6

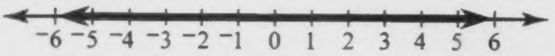
D 
⁻6 ⁻5 ⁻4 ⁻3 ⁻2 ⁻1 0 1 2 3 4 5 6

5 Which of these graphs represents the solution of $x - 4 > 1$ or $2x + 2 \leq {}^-6$?

* A 
⁻6 ⁻5 ⁻4 ⁻3 ⁻2 ⁻1 0 1 2 3 4 5 6

B 
⁻6 ⁻5 ⁻4 ⁻3 ⁻2 ⁻1 0 1 2 3 4 5 6

C 
⁻6 ⁻5 ⁻4 ⁻3 ⁻2 ⁻1 0 1 2 3 4 5 6

D 
⁻6 ⁻5 ⁻4 ⁻3 ⁻2 ⁻1 0 1 2 3 4 5 6

STANDARD VI: The student will be able to represent problem situations.

OBJECTIVE

1. Translate verbal or symbolic information into algebraic expressions; or identify equations or inequalities that represent graphs or problem situations.

ELIGIBLE CONTENT

- Determining an equation or expression when given a verbal description may be required.
- Graphing inequalities using a number line may be required.
- Determining the equation of a line given two ordered pairs may be required.
- Determining the equation of a line given the line graphed on the coordinate plane may be required.

SAMPLE ITEMS

1 Which of these equations represents this statement?

Fourteen more than $\frac{1}{5}$ of a number x is equal to 24.

A $(14+\frac{1}{5})x=24$

B $\frac{1}{5}(x+14)=24$

* **C** $\frac{1}{5}x+14=24$

D $14+\frac{1}{5}+x=24$

2 When pouring concrete, a good rule for estimating the number of workers needed is to have one worker for every 2 cubic yards of concrete plus one other worker. Which of these equations represents this rule?

A $y=2x+1$

* **B** $y=\frac{x}{2}+1$

C $y=\frac{x+1}{2}$

D $y=\frac{2x+1}{2}$

3 What is the equation of the line passing through the points $(1,2)$ and $(3,4)$?

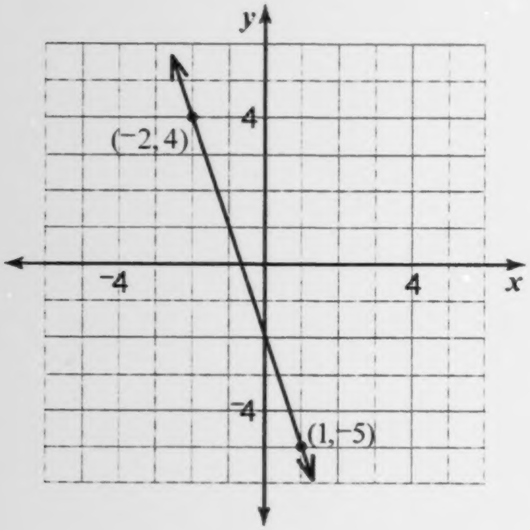
* **A** $y=x+1$

B $y=x-1$

C $x+y=1$

D $x+y=2$

4 What is the equation of the line shown in the graph below?



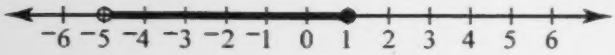
A $y = {}^{-}x - 2$

B $y = {}^{-}2x + 3$

* **C** $y = {}^{-}3x - 2$

D $y = {}^{-}3x + 2$

5 Which of these inequalities describes this graph?



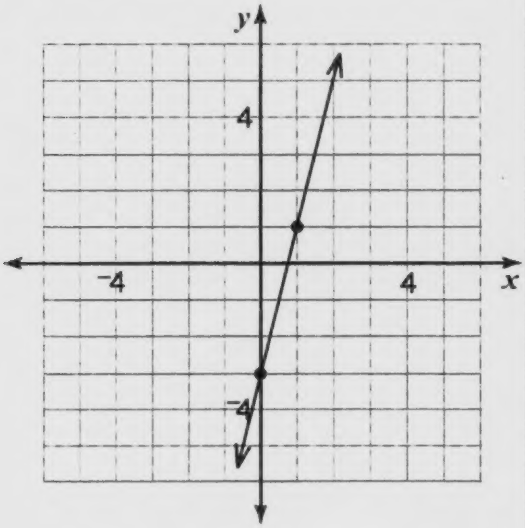
A ${}^{-}5 < x < 1$

* **B** ${}^{-}5 < x \leq 1$

C ${}^{-}5 \leq x \leq 1$

D ${}^{-}5 \leq x < 1$

6 What is the equation of the line shown in the graph below?



* **A** $y = 4x - 3$

B $y = 4x + 3$

C $y = {}^{-}4x - 3$

D $y = {}^{-}4x + 3$

7 Which of these statements is the same as $x^2 + 2x = 8$?

* **A** A number x squared plus 2 times the number x is 8.

B The sum of 2 times a number x and the number x is 8.

C Two times a number x squared plus the number x is 8.

D Two times the sum of a number x squared and the number x is 8.

8 What is the equation of a line with slope $\frac{1}{3}$ that passes through the point $({}^{-}1, {}^{-}2)$?

A $y = \frac{1}{3}x - \frac{1}{3}$

* **B** $y = \frac{1}{3}x - \frac{5}{3}$

C $y = 3x + 1$

D $y = 3x + 5$

STANDARD VII: The student will be able to solve problems involving a variety of algebraic and geometric concepts.

OBJECTIVE

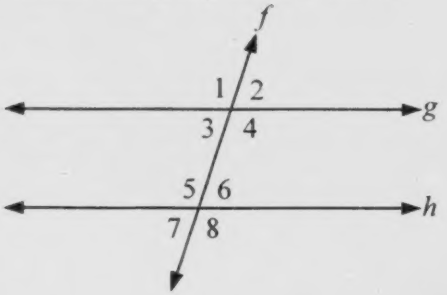
1. Apply properties of angles and relationships between angles.

ELIGIBLE CONTENT

- The following properties and relationships may be included:
  - vertical angles
  - adjacent angles
  - supplementary angles
  - complementary angles
  - linear pair (adjacent supplementary angles)
  - relationships among the measures of angles formed by two parallel lines and a transversal
- Word problems may be used.
- The knowledge of the sum of measures of angles may be used.
- Determining measurements of angles when the measurements of angles are expressed as algebraic expressions may be required.

SAMPLE ITEMS

1 Given: Line *g* is parallel to line *h*.



If $m\angle 3 = 72^\circ$, what is the sum of $m\angle 8$ and $m\angle 5$?

A 72°

B 108°

C 114°

* **D** 216°

2 A convex polygon has 9 sides. What is the sum of the measures of the interior angles?

* **A** 1260°

B 1618°

C 1620°

D 1980°

3 The measure of an angle in degrees is $3x$. Which of these represents the measure of its supplement?

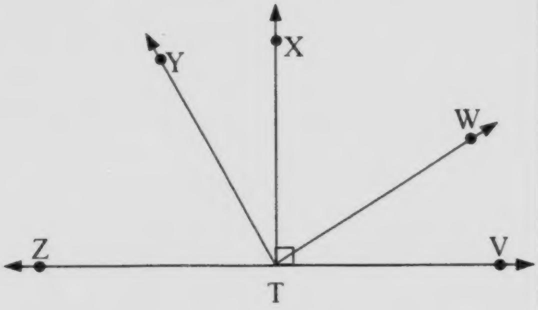
A $3x+90$

B $3x+180$

C $90-3x$

* **D** $180-3x$

4 In the diagram below, $m\angle WTV = 30°$, $m\angle YTV = 120°$, and $m\angle XTV = 90°$.



Which of these angles has the same measure as ∠WTV?

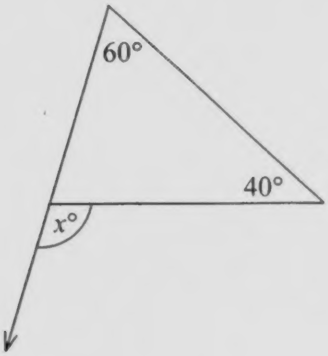
A ∠XTW

* **B** ∠YTX

C ∠YTW

D ∠ZTY

5 What is the value of x?



A 40°

B 60°

C 80°

* **D** 100°

6 What is the supplement of an angle that measures 60° ?

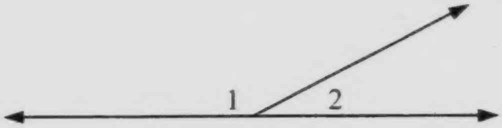
A 30°

B 60°

* **C** 120°

D 150°

7 Given: ∠1 and ∠2 are a linear pair.



If $m\angle 1$ is eight times $m\angle 2$, what is $m\angle 1$?

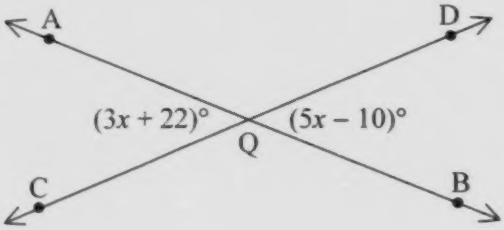
A 20°

B 22.5°

C 157.5°

* **D** 160°

8 Lines AB and CD intersect at point Q. What is the measure of ∠AQC?



A 16°

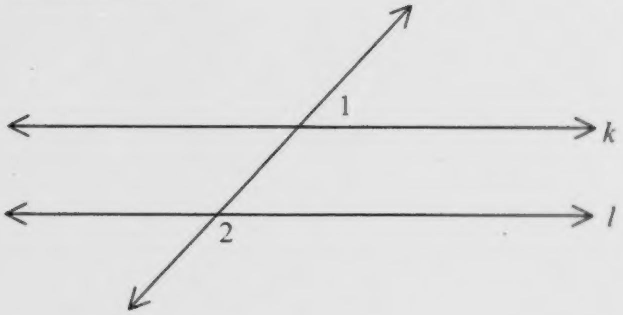
B 21°

* **C** 70°

D 85°

9 Given: $k \parallel l$, $m\angle 1 = 55°$

What is $m\angle 2$?



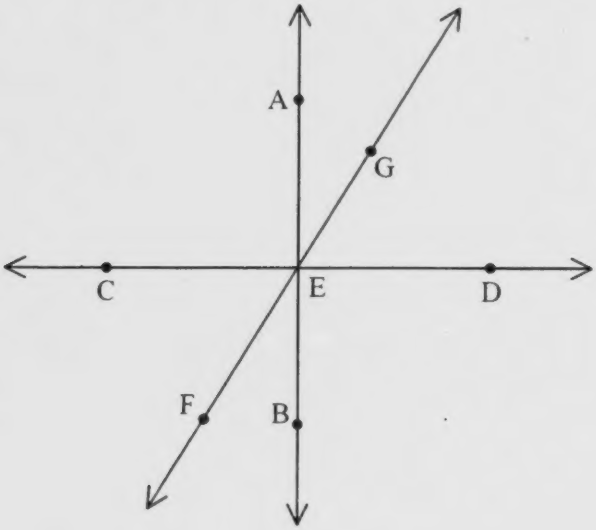
A 25°

B 55°

* **C** 125°

D 155°

10 Given: $\overleftrightarrow{AB} \perp \overleftrightarrow{CD}$, $m\angle AED = (5x + 40)°$, $m\angle FEB = (3x)°$
What is the value of $m\angle AEG$?



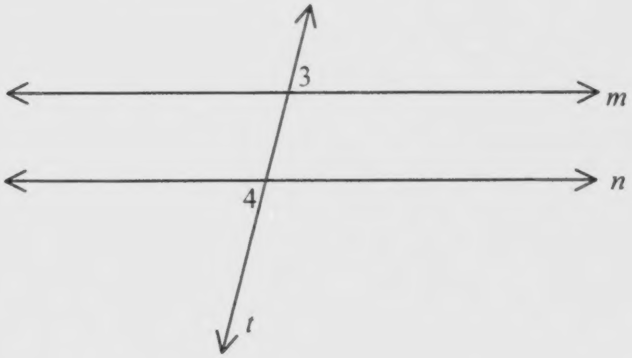
A 28°

* **B** 30°

C 60°

D 96°

11 Given: $m \parallel n$, $m\angle 3 = (2x + 5)°$, $m\angle 4 = (3x - 20)°$
What is the value of x?



A 21

***B** 25

C 39

D 55

STANDARD VII: The student will be able to solve problems involving a variety of algebraic and geometric concepts.

OBJECTIVE

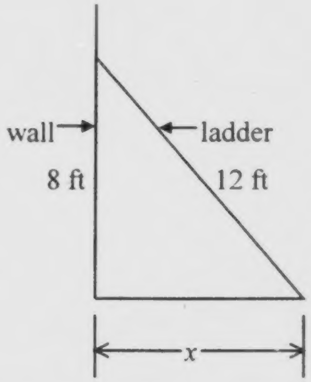
2. Apply Pythagorean Theorem.

ELIGIBLE CONTENT

- The Pythagorean Theorem will be given on the reference page.
- Diagrams will be included.
- Word problems will be used.
- Radicals may be included in options.
- All radicals will be simplified.
- Drawings will be to scale.

SAMPLE ITEMS

1 Peter uses a 12-foot ladder to wash windows at his house.



What is the distance (x) from the base of the wall to the bottom of the ladder?

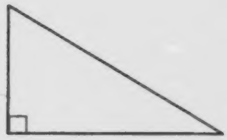
* **A** $4\sqrt{5}$ feet

B $4\sqrt{13}$ feet

C $16\sqrt{5}$ feet

D $16\sqrt{13}$ feet

2 Which of these sets of numbers could be the lengths of the sides of a right triangle?



A {2, 3, 4}

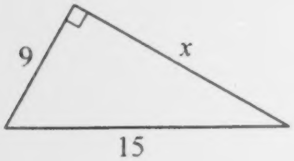
B {3, 4, 6}

* **C** {5, 12, 13}

D {6, 10, 11}

228

3 What is the value of x in the right triangle below?



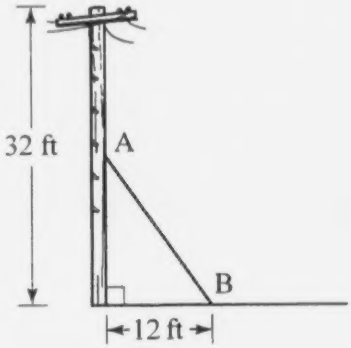
A 6

* **B** 12

C $\sqrt{6}$

D $3\sqrt{34}$

4 The diagram below shows a 32-foot telephone pole. An electrician wants to connect a support wire from point A, halfway up the pole, to point B.



What is the length of the wire?

A 12 feet

B 16 feet

* **C** 20 feet

D 34 feet

STANDARD VII: The student will be able to solve problems involving a variety of algebraic and geometric concepts.

OBJECTIVE

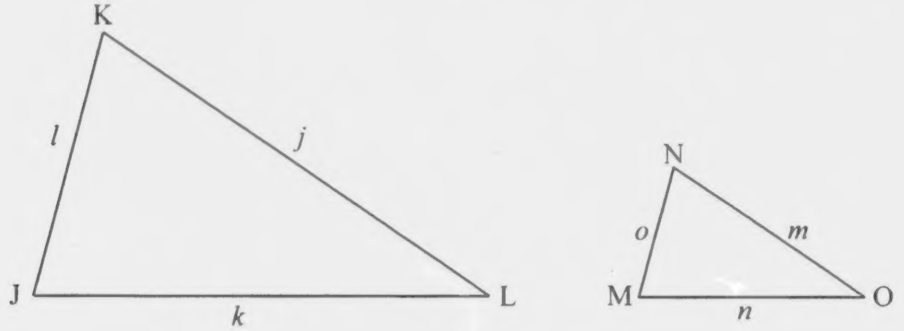
3. Apply properties of similar polygons.

ELIGIBLE CONTENT

- Diagrams may be included.
- Drawings will be to scale.
- The word *similar* or the symbol "~" may be used.
- Use of the scale factor will be required.

SAMPLE ITEMS

1 If Δ JKL ~ Δ MNO, which of these proportions is true?



A $\frac{m}{n} = \frac{j}{l}$

B $\frac{m}{n} = \frac{o}{l}$

C $\frac{m}{n} = \frac{l}{j}$

* D $\frac{m}{n} = \frac{j}{k}$

2 Which of these dimensions form a rectangle similar to a rectangle with a width of 2 inches and a length of 5 inches?

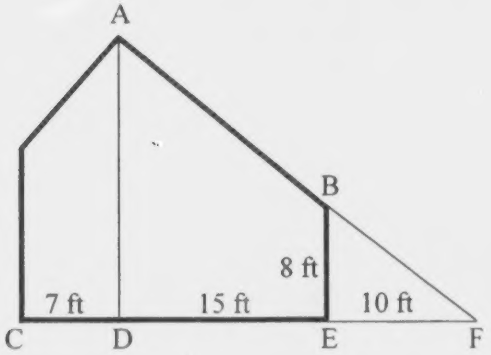
A 2 inches by 10 inches

B 4 inches by 25 inches

C 6 inches by 9 inches

* **D** 6 inches by 15 inches

3 In the house plan shown below, figure FEB is similar to figure FDA.



What is the length of segment AD?

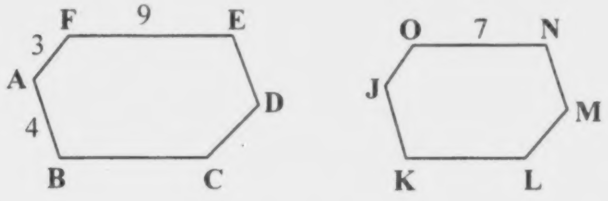
A 12 feet

* **B** 20 feet

C 30 feet

D 35 feet

4 If ABCDEF ~ JKLMNO, what is the length of segment JK?



A 2

B $2\frac{1}{3}$

* **C** $3\frac{1}{9}$

D 6

5 The bases for a major league baseball field form a square that is 90 feet long on each side. The bases for a little league field form a square that is 60 feet long on each side. What is the ratio of the area of the major league baseball field to the area of the little league field?

A $\frac{3}{2}$

B $\frac{2}{3}$

* C $\frac{9}{4}$

D $\frac{4}{9}$

6 Which of these dimensions would form a rectangle that is similar to a rectangle with sides measuring 49×14?

A 9×4

B 8×3

* C 7×2

D 6×2

STANDARD VII: The student will be able to solve problems involving a variety of algebraic and geometric concepts.

OBJECTIVE

4. Apply properties of plane and solid geometric figures.

ELIGIBLE CONTENT

- Diagrams may be included.
- Word problems may be used.
- The following content may be included:
  - area and perimeter of triangles, rectangles, and squares
  - area and circumference of a circle, given radius or diameter
  - perimeter of a regular polygon, given one side
  - volume of rectangular prism or cylinder
  - sum of the measures of the angles in a triangle
  - sum of the measures of the angles in a rectangle
- Determining any dimension of a figure may be required.
- Determining any dimension of a figure when the dimension is expressed as an algebraic expression may be required.

SAMPLE ITEMS

1 A box has a volume of 2880 cubic inches, a height of 20 inches, and a square base. What is the length of a side of the base?

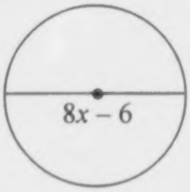
* **A** 12 inches

B 24 inches

C 48 inches

D 144 inches

2 What is the area of a circle with $d = 8x - 6$?



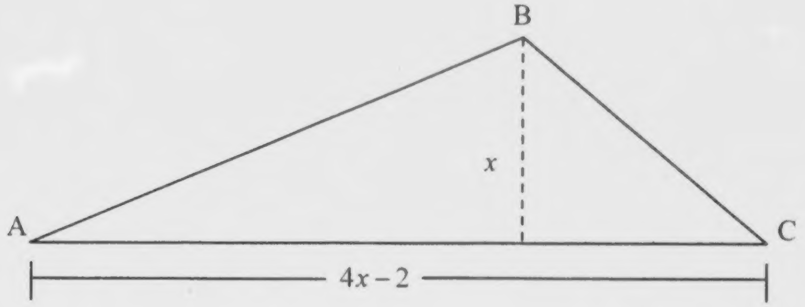
A $(16x - 12)\pi$

B $(28x + 9)\pi$

C $(16x^2 + 12x + 9)\pi$

* **D** $(16x^2 - 24x + 9)\pi$

3 What is the area of the triangle ABC?



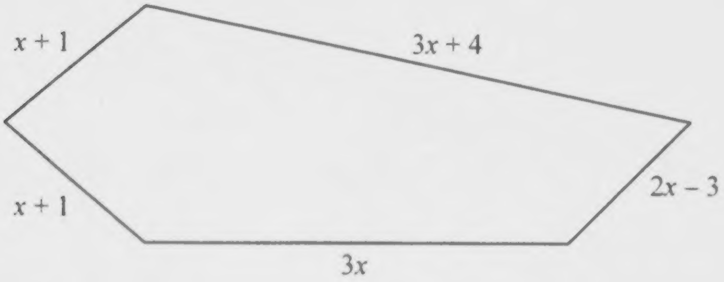
* **A** $2x^2 - x$

B $2x^2 - 1$

C $2x^2 - 2x$

D $2x^2 - 2$

4 If the perimeter of the figure shown below is 33 centimeters, what is the value of x?



A $\frac{12}{5}$

* **B** 3

C $\frac{18}{5}$

D 33

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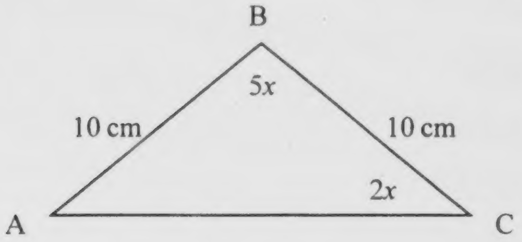
5 What is the measure of angle A in the figure below?


B
5x
10 cm
10 cm
2x
A
C

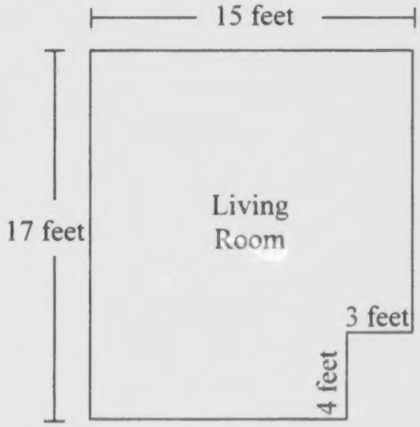
A 20°

B 30°

***C** 40°

D 50°

6 How many square feet of carpet are needed to cover the living room shown in the diagram below?


15 feet
17 feet
Living Room
3 feet
4 feet

A 210 square feet

B 222 square feet

***C** 243 square feet

D 255 square feet

7 A circular manhole has a lid that has a circumference of 26π inches. What is the area of the lid?

* **A** 169π square inches

B 676π square inches

C 169 square inches

D 676 square inches

8 A pool was built in the shape of a circle with diameter $d = 10$ feet. What is the approximate distance around the pool?

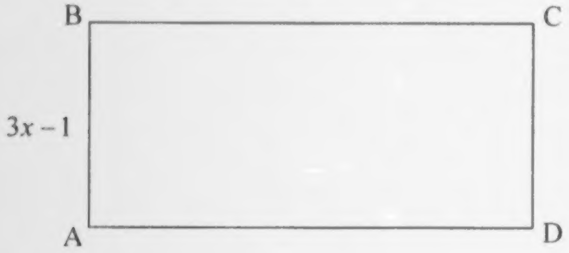
A 18 feet

* **B** 31 feet

C 63 feet

D 78 feet

9 The perimeter of the rectangle shown below is $16x + 8$. The length of side AB is $3x - 1$. What is the length of side AD?



A $5x + 3$

* **B** $5x + 5$

C $10x + 10$

D $13x + 9$

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STANDARD VII: The student will be able to solve problems involving a variety of algebraic and geometric concepts.

OBJECTIVE

5. Determine measures of central tendency.

ELIGIBLE CONTENT

- The word "mean" will be used for the arithmetic average.
- The set of numbers used to assess the range will not be in numerical order.
- Decimals up to hundredths may be used.
- Decimals with different numbers of decimal digits may be used in the same item.
- Frequency diagrams may be used.

SAMPLE ITEMS

1 Seven students in gym class shot 20 free throws each. The number of free throws made successfully is shown in the table below.

FREE THROW RESULTS

Student	1	2	3	4	5	6	7
Successful Free Throws	5	15	13	15	8	10	18

What is the median number of free throws made successfully?

A 12

***B** 13

C 14

D 15

2 The average high temperatures for a city during the month of October are shown in the table below.

AVERAGE HIGH TEMPERATURES

Year	**Temperature**
1990	83°
1991	76°
1992	86°
1993	88°
1994	62°
1995	76°
1996	82°

What is the mean of the average high temperatures?

A 76°
* **B** 79°
C 82°
D 88°

3 What is the mode of this set of data?

5, 6, 10, 8, 5, 10, 5

* **A** 5
B 6
C 7
D 10

4 The frequency table shows the average number of hours students in a class spend each day on math homework. What is the mode of the average hours?

DAILY AVERAGE HOURS OF MATH HOMEWORK

Average Hours	Frequency
1	5
2	7
3	8
4	2
5	1
6	1

A $2\frac{1}{2}$ hours

* **B** 3 hours

C $3\frac{1}{2}$ hours

D 8 hours

5 What is the median of this set of data?

51.2, 19.5, 39.3, 31.9, 45.3, 37.9, 32.3

A 31.9

B 36.8

* **C** 37.9

D 39.3

6 In the first four years of his career, a baseball player had batting averages of .460, .490, .540, and .520. If he wants his mean batting average to be .550 at the end of five years, what batting average must he get in his fifth year?

A .190

B .512

C .550

* **D** .740

7 The table below shows Alex's scores during a golf tournament.

Golf Tournament	
Round	**Score**
1	74
2	67
3	
4	72
5	69

If Alex's mean of the five scores was 70, what was his score in the third round?

A 67

* **B** 68

C 69

D 70

STANDARD VII: The student will be able to solve problems involving a variety of algebraic and geometric concepts.

OBJECTIVE

6. Determine probabilities.

ELIGIBLE CONTENT

- Both AND and OR situations may be included.

SAMPLE ITEMS

1 A committee consists of 6 students and 4 teachers. If two committee members are selected at random, what is the probability that the first member selected is a student and the second member is a teacher?

A $\frac{1}{5}$

***B** $\frac{4}{15}$

C $\frac{1}{24}$

D $\frac{6}{25}$

2 In a group of 10 students, 2 were born in April, 3 in May, 3 in July, and 2 in October. If a student is chosen at random, what is the probability that the student was born in April or October?

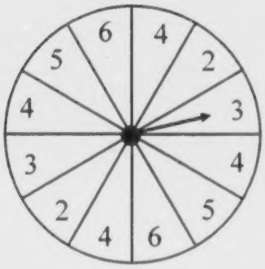
A $\frac{1}{5}$

***B** $\frac{2}{5}$

C $\frac{3}{5}$

D $\frac{4}{5}$

3 What is the probability of spinning a 4 on the spinner below?



A $\frac{1}{12}$

B $\frac{1}{4}$

* **C** $\frac{1}{3}$

D $\frac{1}{2}$

4 A bag contains 30 balls—8 white, 7 red, 9 green, and 6 blue. If one ball is drawn at random, what is the probability that it is white?

A $\frac{1}{30}$

* **B** $\frac{4}{15}$

C $\frac{1}{4}$

D $\frac{2}{15}$

5 Ten colored marbles are placed in a box—4 red, 2 yellow, and 4 green. In a random drawing, two marbles are chosen without replacement. What is the probability that the first marble selected will be red and the second marble will be green?

A $\frac{2}{15}$

B $\frac{3}{25}$

C $\frac{4}{25}$

* **D** $\frac{8}{45}$

6 The table shows the distribution of positions on a soccer team. To select the game captain, each player's name is written on a ball.

SOCCER TEAM POSITIONS

Position	Number of Players
Goalie	1
Center forward	1
Wing	2
Halfback	3
Fullback	4
Total Players	11

If one ball is drawn at random, what is the probability of selecting a goalie or a wing?

A $\frac{2}{11}$

* **B** $\frac{3}{11}$

C $\frac{5}{11}$

D $\frac{6}{11}$

STANDARD VII: The student will be able to solve problems involving a variety of algebraic and geometric concepts.

OBJECTIVE

7. Solve problems involving direct variation.

ELIGIBLE CONTENT

- Diagrams may be used.
- Verbal descriptions of proportions may be used.

SAMPLE ITEMS

1 Lou would like to exchange 354 British pounds for U.S. dollars. If 1 U.S. dollar is equal to 0.59 British pounds, how many U.S. dollars will Lou receive?

A $145.14
B $208.86
*** C** $600.00
D $863.41

2 The scale of a map is $\frac{1}{4}$ inch = 40 miles. If two cities are located 6 inches apart on the map, what is the actual distance between them?

A 60 miles
B 160 miles
C 240 miles
*** D** 960 miles

3 A model airplane is built to a scale of 1:36. If the length of the model is 12 inches, what is the length of the actual airplane?

A 30 feet
*** B** 36 feet
C 360 feet
D 432 feet

4 The speed of sound in dry air at a temperature of 0° C (32° F) is 331.6 m/sec. How far would sound travel in 3 minutes?

A 994.8 meters
B 19,896 meters
*** C** 59,688 meters
D 71,625,600 meters

5 In an equation, y varies directly with x. If $x = 6$ when $y = 16$, what is the value of x when $y = 64$?

A $1\frac{1}{2}$

* B 24

C 16

D $170\frac{2}{3}$

6 A roofer can install 100 square feet of shingles in 60 minutes. At this rate, how long will it take to install 240 square feet of shingles?

A 40 minutes

B 50 minutes

* C 144 minutes

D 400 minutes

7 In an equation, x and y vary directly. If $x = 3$ when $y = {}^{-}\frac{3}{2}$, which of these equations shows the relationship of x and y ?

* A $y = {}^{-}\frac{1}{2}x$

B $y = {}^{-}\frac{3}{2}x$

C $y = {}^{-}2x$

D $y = 3x$

8 The ratios required for a certain orange paint mix are 1 part white to 2 parts red to 3 parts yellow. If 6 pints of red are used, how much yellow is needed?

A $1\frac{2}{3}$ pints

B $2\frac{1}{3}$ pints

* C 9 pints

D 4 pints

STANDARD VII: The student will be able to solve problems involving a variety of algebraic and geometric concepts.

OBJECTIVE

8. Solve problems involving algebraic concepts.

ELIGIBLE CONTENT

- Word problems will be used.
- Interpretation of figures may be required.
- The following content may be included:
  - distance-rate-time problems
  - money problems, which may require a system of equations
  - numbers (sum, difference, product, quotient)
  - simple age problems referring only to the present
  - consecutive integers
  - area, volume, dimension problems
  - quantity problems
  - cost problems
  - wage problems

SAMPLE ITEMS

1 Mr. Ward drove from his office to a business meeting at an average speed of 60 miles per hour. When he drove the same route on the return trip, his average speed was 55 mph, and the trip took $\frac{1}{4}$ hour longer. What was Mr. Ward's total travel time?

A $2\frac{3}{4}$ hours

B 3 hours

C $5\frac{1}{2}$ hours

* **D** $5\frac{3}{4}$ hours

2 Pants cost $5.00 more than shirts. If John buys 3 shirts and 3 pairs of pants for a total of $135, how much does one pair of pants cost?

A $18.33

B $20.00

C $23.33

* **D** $25.00

3 A new savings account was opened with a deposit of $5000. Part of the money earned 4% interest and the remainder earned 9%. The account earned a total of $385 in simple interest during one year. How much money was invested to earn 9% interest?

A $1300

B $2500

* C $3700

D $4500

4 The sum of 3 consecutive integers is 81. What is the value of the middle integer?

A 26

* B 27

C 28

D 29

5 Ryan makes $3.00 per hour more than Scott. If 3 times Ryan's rate plus 4 times Scott's rate is $65.00, what is Ryan's hourly wage?

A $7.57

B $8.00

C $9.71

* D $11.00

6 The volume of a telephone book is 198 cubic inches. The book is 2 inches thick and the pages are 2 inches longer than the width. What is the width of the telephone book?

A $8\frac{1}{2}$ inches

* B 9 inches

C $10\frac{1}{2}$ inches

D 11 inches

7 The area of a rectangular lot is 112 square feet. The width is 6 feet less than the length. What is the length of the lot?

A 7 feet

B 8 feet

* C 14 feet

D 24 feet

8 John is 3 times as old as Beth. The sum of their ages is 36. How old is John?

A 9

B 12

C 18

* D 27

9 The sum of two numbers is 58. The difference between three times the small number and the larger number is 38. What is the value of the smallest number?

A 5

B 10

C 12

* D 24

F. ITEM SPECIFICATIONS: READING COMPREHENSION

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INTRODUCTION

This bulletin provides specific information about the *Alabama High School Graduation Exam*, Third Edition (AHSGE). Educators representing each state school board district as well as both city and county school systems served on the committees that determined the standards and objectives; determined the eligible content for the test; and reviewed, revised, and approved the actual items.

The standards and objectives for the AHSGE are also found in *Standards and Objectives (Reading Comprehension, Language, Mathematics, and Science) for the Alabama High School Graduation Exam,* Bulletin 1997, No. 16, and *Standards and Objectives (Social Studies) for the Alabama High School Graduation Exam,* Bulletin 1998, No. 13. The standards and objectives for reading are specifically referenced in this document.

Teachers must be familiar with this document if they teach content that relates to the objectives measured on the graduation exam in the middle grades or in the high school grades. Further, teachers must use this document in focusing instruction for students who have demonstrated weaknesses on objectives measured on the pre-graduation examination and the AHSGE.

An item specification has a distinct purpose and provides essential information concerning the testing of an objective. Item specifications for reading will follow this order:

STANDARD	Broad area of content to be assessed
OBJECTIVE	Specific skill within a standard to be assessed
ELIGIBLE CONTENT	Clarification and elaboration of an objective (where applicable)
SAMPLE ITEMS	Item formats to test each objective

The sample items in this bulletin will **not** be found on the pre-graduation examination or the AHSGE. The number of sample items in this bulletin does not necessarily reflect the weight of the content on the test. In order to identify the weight of the content, the following chart shows the number of items for each reading objective.

OBJECTIVES		NUMBER OF ITEMS
I-1	Identify supporting details	6
I-2	Determine sequence of events	6
I-3	Follow directions	6
II-1	Identify main idea	6
II-2	Draw conclusions	6
II-3	Determine cause and effect	6
II-4	Propaganda; Fact from opinion	6
II-5	Recognize summary statements	6
III-1	Recognize logic and arguments	6
III-2	Analyze literary elements	6
III-3	Understand figurative language	6
IV-1	Determine meaning of words	6
IV-2	Preview, predict	6 items combined
IV-3	Discern organizational patterns	
IV-4	Demonstrate reference material usage	6
TOTAL		84

Educators from each state school board district as well as both city and county school systems served on a committee to select appropriate reading passages to be included on the reading comprehension test. The committee members considered passages individually in order to determine their appropriateness. Some of the criteria used to judge each passage included length, difficulty level, interest level, age appropriateness, and appropriateness for students of special populations.

Most passages have been taken from authentic sources. Some have been edited to avoid possible bias or for reasons of length or appropriateness. Reading passages on the AHSGE may be broadly categorized as these three text types:

Textual materials generally read for information, such as charts, graphs, encyclopedias, news magazines, essays, lab manuals, and material found in textbooks.

Recreational materials generally read for pleasure, such as magazines, poetry, novels, and short stories.

Functional materials generally read for a precise action, such as directions, maps, schedules (television, bus), menus (computer, restaurant), catalogues, instructions, and other material generally encountered in everyday life beyond the classroom.

On each reading test, approximately half the reading passages are textual; the other half of the test is split between recreational and functional reading materials. The passages may range in length from a single page to three pages, with a total of 12–14 passages on each reading test. Each reading passage measures more than one objective.

PASSAGES

WITH ITEMS

Read the following article and poem and answer Numbers 1 through 9. You may look back at the article and poem as often as you like.

Dorothy Parker

more than just a wit

by Lisa Burdige

Dorothy Parker was famous for saying what was on her mind. In fact, her biting, clever jibes are the stuff of literary legend. But Parker was more than just a wit; she was an acclaimed poet, short-story writer, journalist, and screenwriter whose 28 films included *A Star Is Born*. She was also the brightest light of the Algonquin Round Table, an assemblage of writers who met every day at the Algonquin Hotel in New York City from 1919 into the forties, and did much to shape American popular culture.

Little is known about Dorothy Parker's early life. She was born Dorothy Rothschild in 1893. Her mother died in Dorothy's infancy, and Dorothy was raised in New York City, where she attended a Catholic convent school. She later said the only thing school taught her was that "if you spit on a pencil eraser, it will erase ink." Left without an income when her father died, the twenty-year-old Parker began her career, first as a copywriter for *Vogue* then, one year later, as drama critic for *Vanity Fair*. For four years she brought her distinctive brand of biting wit to her reviews. For example, of Katherine Hepburn's performance in a Broadway play, she wrote, "Ms. Hepburn ran the whole gamut of emotions from A to B."

Parker's stories, however, show another side of the writer. "Dear God," she wrote in a letter to a friend, "please make me stop writing like a woman." For Parker, "writing like a woman" meant scrutinizing the foibles and, often, the falsity of romance. Her accomplished, pained tales of love and betrayal are very different from her hard-edged public persona.

Over the span of her career, Parker wrote 51 short stories, 4 volumes of verse, several volumes of nonfiction and essays, a detective novel, 28 screenplays, and several plays. She received the O. Henry Award for her story "Big Blonde" in 1929. Harold Ross, founder of *The New Yorker* magazine, credited Parker with the creation of *The New Yorker* short story, though Parker herself denied that such a genre existed. Throughout her career, Parker was esteemed as a writer of sophistication, skill, and insight, but by the end of her life, she had almost disappeared from public view.

After the death of Alan Campbell[1] in 1963, Parker told a friend, "I'm seventy and feel ninety. If I had any decency, I'd be dead. Most of my friends are." She died in 1967 at the age of seventy-four. Willing to pun at anyone's expense, including her own, she had written the epitaph for her own tombstone, which reads, "Excuse my dust."

---

[1] Parker was married to Alan Campbell but kept the name of her first husband.

Excerpt from "Dorothy Parker: More Than Just a Wit" by Lisa Burdige from *Literary Cavalcade*'s April 1995 issue, copyright
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Now read one of Dorothy Parker's poems, "One Perfect Rose."

ONE PERFECT ROSE

by Dorothy Parker

A single flow'r he sent me, since we met.
All tenderly his messenger he chose;
Deep-hearted, pure, with scented dew still wet—
One perfect rose.

I knew the language of the floweret;
"My fragile leaves," it said, "his heart enclose."
Love long has taken for his amulet[2]
One perfect rose.

Why is it no one ever sent me yet
One perfect limousine, do you suppose?
Ah no, it's always just my luck to get
One perfect rose.

---

[2] **amulet:** an object worn as a charm

1 The main idea of this article is that Dorothy Parker

A lost her sense of humor at the end of her life.

B is best known for her screenplay *A Star Is Born.*

C often wished that she could write without using humor.

D is famous for both her wit and her insightful tales of love.

2 How did Dorothy Parker begin her career as a writer?

A as a copywriter for *Vogue*

B as a student at convent school

C as a drama critic for *Vanity Fair*

D as a member of the Algonquin Round Table

3 When Dorothy Parker wrote, "Dear God, please make me stop writing like a woman," she meant she would rather write

A with a masculine style.

B without using her wit.

C about something she knows.

D about something other than romantic love.

4 What can the reader conclude about Dorothy Parker's time in school?

A She learned many practical skills.

B She cared little about her education.

C She wrote many humorous essays that got her in trouble.

D She learned everything she needed to know to become a great writer.

"One Perfect Rose" by Dorothy Parker, copyright © 1926, renewed © 1954 by Dorothy Parker, from *The Portable Dorothy Parker* by Dorothy Parker. Used by permission of Viking Penguin, a division of Penguin Putnam, Inc.

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5 What is the theme of the poem?

A Love will last no matter what gifts are given.

B Women desire more than symbolism in a gift.

C Love should be shown through inexpensive gifts.

D Women know a single rose is a better gift than jewelry.

6 What is the tone of the poem?

A angry

B ironic

C tender

D dramatic

7 Who or what is the messenger in the line, "All tenderly his messenger he chose"?

A flower

B limousine

C amulet

D heart

8 Which part of the poem demonstrates Dorothy Parker's wit?

A "A single flow'r he sent me, since we met."

B "Deep-hearted, pure, with scented dew still wet—"

C "Love long has taken for his amulet/One perfect rose."

D "Why is it no one ever sent me yet/One perfect limousine?"

9 What can the reader conclude from the poem about Dorothy Parker's attitude toward roses?

A She appreciates roses as examples of perfection.

B She believes roses symbolize a romantic relationship.

C She thinks roses are a poor substitute for time spent traveling.

D She feels roses are fine but she would like something more substantial.

Read the following newspaper column and answer Numbers 1 through 7. You may look back at the newspaper column as often as you like.

In and of Ourselves We Trust

by Andy Rooney

"In and of Ourselves We Trust" was one of Rooney's syndicated columns. Rooney's piece uses one simple example to illustrate a generality. He draws from it a far-reaching set of conclusions: that we have a "contract" with each other to stop for red lights—and further, that our whole system of trust depends on everyone doing the right thing.

Last night I was driving from Harrisburg to Lewisburg, Pennsylvania, a distance of about 80 miles. It was late, I was late, and if anyone asked me how fast I was driving, I'd have to plead the Fifth Amendment to avoid self-incrimination.

At one point along an open highway, I came to a crossroads with a traffic light. I was alone on the road by now, but as I approached the light, it turned red, and I braked to a halt. I looked left, right, and behind me. Nothing. Not a car, no suggestion of headlights, but there I sat, waiting for the light to change, the only human being, for at least a mile in any direction.

I started wondering why I refused to run the light. I was not afraid of being arrested, because there was obviously no cop anywhere around and there certainly would have been no danger in going through it.

Much later that night, after I'd met with a group in Lewisburg and had climbed into bed near midnight, the question of why I'd stopped for that light came back to me. I think I stopped because it's part of a contract we all have with each other. It's not only the law, but it's an agreement we have, and we trust each other to honor it: We don't go through red lights. Like most of us, I'm more apt to be restrained from doing something bad by the social convention that disapproves of it than by any law against it.

It's amazing that we ever trust each other to do the right thing, isn't it? And we do, too. Trust is our first inclination. We have to make a deliberate decision to mistrust someone or to be suspicious or skeptical.

It's a darn good thing, too, because the whole structure of our society depends on mutual trust, not distrust. This whole thing we have going for us would fall apart if we didn't trust each other most of the time. In Italy they have an awful time getting any money for the government because many people just plain don't pay their income tax. Here, the Internal Revenue Service makes some gestures toward enforcing the law, but mostly they just have to trust that we'll pay what we owe. There has often been talk of a tax revolt in this country, and our government pretty much admits that if there were a widespread tax revolt here, they wouldn't be able to do anything about it.

We do what we say we'll do. We show up when we say we'll show up.

I was so proud of myself for stopping for that red light. And inasmuch as no one would ever have known what a good person I was on the road from Harrisburg to Lewisburg, I had to tell someone.

"In and of Ourselves We Trust" by Andy Rooney, copyright © Tribune Services, Inc. All rights reserved. Reprinted by permission.

1 Which set of statements BEST summarizes this newspaper column?

A The Internal Revenue Service needs to enforce stronger tax laws. Otherwise, no one will pay taxes.

B The stability of society is built on trust. Without trust the contract we have with each other would be destroyed.

C If we did not trust each other, there would be a tax revolt. The contract we have with each other would be destroyed.

D Through trusting each other to obey laws, we build a solid government. We must have a strong police force in order to ensure that stability.

2 What is the most convincing reason Rooney gives for not going through the red light?

A It is against the law.

B We just don't go through red lights.

C It is part of a contract we have with each other.

D We stop in this situation because it makes us feel proud.

3 Rooney's statement "We do what we say we'll do. We show up when we say we'll show up" supports his belief that Americans are

A proud.

B prompt.

C trustworthy.

D complacent.

4 Why does Rooney change from "I" to "we" about halfway through the newspaper column?

A to urge readers to obey traffic laws

B to enable readers to understand the social contract

C to encourage readers to identify with his point of view

D to lead readers to consider conventions more important than laws

5 When does Andy Rooney decide that he stopped at the red light "because it's part of a contract we all have with each other"?

A after he goes to bed

B while braking for the light

C during his wait at the light

D before he reaches Lewisburg

6 What is the main idea of this newspaper column?

A We must trust each other in order to have a stable society.

B We stop at red lights because we obey social conventions.

C We should pay our taxes even when we don't agree with the government.

D We tell others about our honesty so they will be more likely to follow the rules.

7 What can you conclude about Andy Rooney from this newspaper column?

A He believes most people mistrust others.

B He considers himself a law-abiding citizen.

C He thinks that he is perfect.

D He trusts the Internal Revenue Service.

Read the following true story and answer Numbers 1 through 8. You may look back at the story as often as you like.

Just Two Points Make One Dream Come True

by Mitch Albom

TUCSON, Ariz.—He didn't want much. Just one basket. That's not a lot to ask from a college career, is it? One basket?

For this, he would work. For this, he would sacrifice. For this he would sit at the end of the bench, night after night, year after year. Without a scholarship. Without fame. He would travel to cities, dress in the uniform, go through warm-ups. Then take off the uniform, travel back home, go to class. Year after year. Night after night.

One basket.

Sean Dobbins is the other side of the Fab Five. The far side. He was a good little high school basketball player who chose Michigan, like most kids, to get an education. He paid his own tuition. No one recruited him.

One day, early in his freshman year, Dobbins got an idea. He took his high school scrapbook to the basketball office and asked to see Steve Fisher.

"Coach, I'd like to play for your team," he said. "These are some articles about me in high school."

Fisher, who had just won a national championship, was amused. Big-time college basketball schools begin recruiting players when they are in eighth or ninth grade. They follow them—hound them, sometimes—until they sign. Only the best get taken.

Now here was a kid with a scrapbook.

"I'll take a look," Fisher said.

Finding room on the roster

Five weeks later—to everyone's surprise—Dobbins was on the team. A walk-on. True, he still had to pay his own tuition. True, he was mostly there to help practice. But the kid with the scrapbook was in the club, dressing next to stars like Rumeal Robinson and Terry Mills.

He went through drills. He sweated every scrimmage. He dressed for the games, but almost never got in. To be honest, it was a big deal if he unzipped his sweat suit.

Sophomore year, he made a free throw.

That was the highlight of his season.

"I still dreamed about making a basket," he says. "I figured I had two years left."

Then, a setback. Michigan recruited five star freshmen—the Fab Five—and there was no room on the team for Dobbins. He spent his junior year practicing in the gym with other students. When the NCAA tournament came around, he drove to Atlanta, on his own. And he drove to Lexington. And he drove to Minneapolis. He sat behind the team, in the stands, longing to be part of it again, to wear the uniform, to maybe get a shot at that one basket he'd been dreaming about since freshman year.

Suddenly, he was a senior.

"Just Two Points Make One Dream Come True" by Mitch Albom from the *Detroit Free Press*' March 21, 1993 issue, copyright © 1993 by the *Detroit Free Press*. Reprinted by permission.

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The free throw just didn't count

"The guys on the team were really pulling for me now," he says. Given his old spot back—and the fact that because U-M was so talented, there should be plenty of "garbage time"—Dobbins was optimistic. He practiced hard, as usual. He dressed and undressed, as usual.

But the games slipped away. Pretty soon, it was the regular-season finale against Northwestern, and Dobbins still hadn't scored a hoop. Fisher put him in, and he quickly took a shot—which clanked off the rim. The crowd moaned. In the final seconds he got the ball again, spun toward the basket and—AHNNNNNNN!

The buzzer sounded. The season was gone. And so, Dobbins figured, was his chance.

Which is what made Friday night so special. Friday night, first game of the NCAA tournament, the most serious basketball of the year. Michigan found itself ahead by 30 points late against Coastal Carolina. Fisher looked down the bench, saw the kid with the scrapbook, and said, "Get in there."

This time, the whole U-M team, which had come to love Dobbins for his never-quit spirit, was ready. With four seconds left, and a free throw about to be shot at the opposite end, the Wolverines called Dobbins over and hid him in their midst. "Don't move," they whispered, "just wait." The other team didn't even see him.

So when the free throw was made, Rob Pelinka grabbed the ball, and heaved it downcourt to Dobbins, who stepped out of the camouflage and was suddenly all alone.

"All I could think was 'Catch it! Catch it!'" Dobbins said.

He caught it. He dribbled toward the basket. Three seconds. Two seconds. He laid it up . . . and in!

Score! The buzzer sounded. And the Wolverines mobbed Dobbins as if he'd just won a championship. "You shoulda dunked it!" laughed Chris Webber. "DOBBS! DOBBS!" yelled Juwan Howard, grabbing him in a headlock and carrying him to the locker room.

We watch so much college basketball, we forget that they are kids out there. Kids with dreams. Some dream of winning it all. Some just dream of scoring two points.

"It was the greatest moment of my life," said Dobbins. "If I never scored, the experience would still have been worthwhile. But now, it feels . . . great."

Mission accomplished.

Unless any NBA teams are interested . . .

1 What is a major theme in this story?

- **A** It takes commitment to reach a goal.
- **B** It takes conviction to sit on the bench.
- **C** It takes persistence to get an education.
- **D** It takes concentration to make a basket.

2 Why does Fisher think it is funny when Dobbins wants to join the Wolverines?

- **A** Fisher's players are national champions.
- **B** Fisher's players often become professionals.
- **C** Fisher knows that Dobbins can't play basketball.
- **D** Fisher thinks that Dobbins's scrapbook is comical.

3 What happens because Dobbins shows his scrapbook to Fisher?

A Dobbins makes the team.
B Dobbins sits in the stands.
C Dobbins drives to Atlanta.
D Dobbins plays his first game.

4 What happens to Dobbins because Michigan recruits the Fab Five?

A He joins an opposing team.
B He drives to different cities.
C He is traded to another team.
D He is dropped from the team.

5 What is the attitude of the Wolverines towards Dobbins?

A lenient
B tolerant
C admiring
D flattering

6 What word BEST describes Dobbins's character?

A critical
B humorous
C pessimistic
D determined

7 What method does the author use to dramatize the final scene of his story?

A He interviews the coach.
B He quotes two ballplayers.
C He mentions the scrapbook.
D He discusses team motivation.

8 Which set of statements BEST summarizes the story?

A Sean Dobbins wanted to score a two-point basket during his college basketball career. He scored with a free throw during his sophomore year but still wanted a two-point basket. Even though he never got to play, his teammates loved his spirit.

B Sean Dobbins dreamed of making a two-point basket during his college basketball career. Through a number of circumstances, he almost lost out on that dream. But in his senior year he finally realized his goal when he scored a basket in the final seconds of a tournament game.

C Sean Dobbins wanted to make a basket during his college basketball career. Even though he scored with a free throw, it was not good enough. He thought that he had two years left in which to score a basket. But unfortunately he had to leave the team when the Fab Five were recruited.

D Sean Dobbins was able to get on the Wolverines team by showing his high school scrapbook to the coach. He played for two seasons but had to leave the team in his junior year when the Fab Five were recruited. He never lost his enthusiasm and got a chance to play again with the team in his senior year.

Read the following story and answer Numbers 1 through 10. You may look back at the story as often as you like.

Saga of a Seagoing Dog

Condensed from SAIL

PETER MUILENBURG

SANTOS, the dog that barked furiously at any hint of danger to others, made not a whimper when he slipped and fell overboard five miles off the Venezuelan coast. We didn't miss him until the morning after we had anchored our ketch,[1] *Breath,* behind the breakwater at Puerto Azul. Suddenly our son Diego called out, "Where's Santos?"

We searched everywhere. Diego even tore open our last package of tortilla chips, crackling the bag noisily and calling Santos, but the dog was gone.

My wife, Dorothy, and I went ashore to notify the port captain of our loss. The captain was busy with the start of a sport-fishing tournament. He offered us no encouragement, but promised to keep an eye out.

We walked over to the beachside bar and began to think what we would tell Diego.

TIME AND AGAIN WE had feared for Santos's life. He had been an endlessly amusing little rogue. One friend called him a hamster masquerading as a wolf, though on close inspection he looked more like a cross between fox and a pint-size husky. He was Diego's constant companion.

Santos had been given to us years ago in a Florida port where we had anchored beside a schooner with two people and seven dogs onboard. Jeanne and Vince were raising schipperkes—Belgian canal-barge dogs—and five puppies had just been born. Jeanne offered us the pick of the litter. "Your ship needs a schipperke," she declared.

I didn't think so, but my objections were blown away in a williwaw[2] of enthusiasm from the crew. I reminded the boys to pick a lively one, and they returned with a ball of jet-black fluff that looked me dead in the eye and growled.

In time Santos developed into a fine boat dog. "Schipperke" means "little captain" in Flemish, and his ancestors were bred to serve aboard Low Country[3] barges. Their duties included swimming ashore in the cold canals to nip the heels of recalcitrant[4] tow horses. And they were programmed to bark if anyone fell overboard, which made them ideal baby sitters for family-run vessels. They were even expected to help the master navigate.

Santos excelled at all these tasks, and more. One night, as a storm was brewing, we tried to gain the shelter of Mayaguana in the Bahamas. After 36 hours of overcast we couldn't be sure of our position. Suddenly Santos roused himself and stood with his nose straining into the wind, whimpering

---

[1] **ketch:** a two-masted sailboat

[2] **williwaw:** a violent gust of cold wind

[3] **Low Countries:** Belgium, the Netherlands, and Luxembourg

[4] **recalcitrant:** stubborn, defiant

"Saga of a Seagoing Dog" by Peter Muilenburg, published in *Reader's Digest*'s October 1992 issue, condensed from an article from *Sail* Magazine's December 1991 issue, copyright © 1991 by Peter Muilenburg. Used by permission.

ardently. We short-tacked up the dog's olfactory bearing[5] and within two hours sighted land.

In addition, this salty dog was endearing company, especially on long night watches. Then he would creep unbidden into the lonely helmsman's lap and rest his muzzle with a sigh of contentment in one's hand.

Intelligence in a dog such as Santos can be a mixed blessing. He knew well what was expected of him, but he also had his own agenda—fun—and this got him into trouble regularly. Before he was three months old, he'd almost drowned twice. Once, charging down the deck in a puppy war game, he shot right out a deckside scupper.[6] We heard scratching on the hull and went topside to find Santos treading water. Luckily it was slack tide.

Then a month later he did it again, and the ebb tide carried him out to sea while we were lunching below. A skin diver noticed his black head and pointed ears and picked him up.

IT WAS TIME to get back to Diego; we couldn't postpone the inevitable any longer.

"Oh, well," I consoled Dorothy, "with that dog's temperament we were lucky to have him as long as we did."

We walked to the dinghy,[7] and I was casting off when we heard a shout. The port captain came hurrying down the steps from his office.

"You won't believe it," he said. "I just called the fishing boats on the radio to tally their standings for the scoreboard." He paused, out of breath.

"And?" we gasped.

"And the last boat said they caught nothing—except a little black dog!"

Back on *Breath,* Santos received a joyous welcome and got his own helping of the family dinner. But his eyes were glazed, as if they'd seen the whole of his life pass before them, and right after supper he crashed. When I drifted off later, I thought about the charmed life Santos led, and wondered whether his brush with death would make a more sensible animal of him.

That fantasy died at dawn, when a flurry of barking awoke us. A fisherman had dared to pass within 150 feet of our boat. A few hours later, seeing some kids playing with a German shepherd on the beach, Santos jumped into the sea and headed for the action. Shortly afterward someone knocked on our hull.

"Hello—is this your dog?"

"Yup," I said. "That's our dog."

---

[5] **short-tacked up the dog's olfactory bearing:** steered the boat in the direction the dog was sniffing

[6] **scupper:** an opening that lets water drain out

[7] **dinghy:** a small rowboat

1 What is the tone of this story?

A nostalgic regret

B harsh irritation

C gentle amusement

D sarcastic mockery

2 When the author first met the dog, Santos seemed

A cheerful.

B miserable.

C unfriendly.

D affectionate.

3 What did Santos do when he FIRST arrived on the boat?

A He fell overboard.

B He growled at the author.

C He barked at a nearby fishing boat.

D He whimpered as he smelled the wind.

4 Why did Diego tear open the "last package of tortilla chips, crackling the bag noisily"?

A to help in the preparation of lunch

B to offer some food to the port captain

C to tempt the dog to come out of hiding

D to encourage the family to eat before leaving

5 Read the following sentence from the story.

He had been an endlessly amusing little rogue.

What does the word *rogue* mean as it is used here?

A rascal

B friend

C stranger

D monster

6 The puppy came to the family when

A Dorothy got lost in the fog off the Bahamas.

B a couple offered them their choice of a litter.

C Santos was working as a canal dog in Europe.

D a fisherman found him swimming near a fishing tournament.

7 Schipperkes helped barges navigate the canals by

A swimming alongside the barges.

B smelling the thick fog to locate land.

C alerting the captain of passengers overboard.

D encouraging tow horses to continue walking.

8 What does the author probably mean by the word *unbidden* when he writes that Santos "would creep unbidden into the lonely helmsman's lap"?

A not aided

B not invited

C not ashamed

D not observed

9 What was the author's reaction to the loss of Santos?

A anger

B optimism

C happiness

D discouragement

10 Which set of statements BEST summarizes the story?

A Santos repeatedly falls or jumps overboard but is returned each time to his family's sailboat. One time he is lost off South America but is brought back by a port captain.

B The author reluctantly accepts a puppy onboard his sailboat. The dog, intelligent and full of fun, endears himself to the family and has a variety of adventures on and off the boat.

C *Breath*, the family sailboat, becomes the home of a happy, adventurous dog. At the end of the story, Santos jumps overboard to play on shore with another dog and some children.

D A family adopts a schipperke puppy that was bred to be aboard a boat and help with navigation. As a puppy, Santos falls overboard twice; one of those times he comes back to the family with a skin diver.

Read the time line and answer Numbers 1 through 6. You may look back at the time line as often as you like.

"The History of the U.S. Postal Service" is the subject Leann Brown has chosen for a research paper. Her first job is to develop an outline, and to do that she checks her reference materials. There she finds something that helps her get started: a Postal Delivery Time Line.

POSTAL DELIVERY TIME LINE

1000 B.C.	Homing pigeons delivered King Solomon's letters to Queen of Sheba.
485–425 B.C.	Greek writer Herodotus described Persian horse postal service: "Neither snow, nor rain, nor heat, nor gloom of night stays these couriers from the swift completion of their appointed rounds."
59–44 B.C.	Julius Caesar used foot runners, then horseback riders; mail was delivered for nobility only.
A.D. 286–288	Roman Emperor Diocletian started postal service for private citizens.
1290	University of Paris began postal service for private citizens.
1591	Queen Elizabeth I established central postal service in Great Britain.
1639	First American post office set up in Boston; one cent charged for each letter.
1672	New York City began mail service to Boston, Massachusetts.
1674	Connecticut began mail service.
1683	William Penn began weekly mail service from Philadelphia to all large Pennsylvania and Maryland towns.
1693	Intercolonial postal service began in all colonies except Virginia.
1775	Benjamin Franklin was appointed first American postmaster general.
1785	Balloon carried letter addressed to Benjamin Franklin from England to France.
1799	Congress passed a death penalty for robbing the mail.
1813	First mail carried by steamboat.
1832	First official railroad mail service.
1860	Pony Express started service between St. Joseph, Missouri, and Sacramento, California.
1893	First commemorative stamps issued at Chicago World's Fair.
1896	Rural Free Delivery began.
1913	Parcel Post Delivery service started.
1918	Airmail stamps first issued.
1918	First regular airmail service in U.S.—Washington, D.C., to New York City.
1920	First transcontinental air mail service, New York to San Francisco.
1941	Post office on wheels, called Highway Post Office (HYPO), initiated.
1958	Famous artists started designing postage stamps.
1959	Transcontinental jet mail service began.
1963	Zip Code numbers put into use.

"Postal Delivery Time Line" by Betty H. Little from *Cobblestone*'s October 1981 issue: The Pony Express: 1860–1861, copyright © 1981 by Cobblestone Publishing Co., 30 Grove St., Suite C, Peterborough, NH 03458. Reprinted by permission of the publisher.

1 This time line is organized according to

A when the events happened.
B where the events happened.
C the importance of the events.
D the people involved in the events.

2 If Leann wants to make the point that mail delivery was often difficult, which fact would be BEST to include in her research paper?

A In 1896, Rural Free Delivery of mail began.
B In 1963, Zip Code numbers were put into use.
C In 1799, Congress passed a death penalty for robbing the mail.
D In 1941, a post office on wheels, called Highway Post Office (HYPO), was initiated.

3 Which phrase BEST describes the main idea of this time line?

A an in-depth history of the postal service
B an international tribute to the postal service
C a detailed history of technological advances in the postal service
D a chronological list of important events concerning the postal service

4 Which date indicates the first effect of scientific advances on the delivery of the mail?

A 1639
B 1813
C 1832
D 1918

5 What might be seen as a major trend in postal service?

A speeding up the time of delivery
B making stamps attractive to collectors
C offering service to the common people
D providing increased security for postal customers

6 When did the first mail travel by air?

A in 1920
B in 1918
C in the 1700s
D in 1000 B.C.

Read the following paragraph and list of Key Words. Answer Numbers 1 through 8. You may look back at the paragraph and list of Key Words as often as you like.

Jesse's social studies teacher assigns the class a research paper on international trade. The students must demonstrate their understanding of the topic by using terms from the following glossary. In addition, the students must provide examples of how countries buy and sell goods. Jesse learns the following terms so that he can use them correctly in his research paper.

KEY WORDS

THE TERMS OF TRADE

Here are a few key words used in international trade.

Domestic: Produced in or native to a country.

Free trade: An exchange of goods and services between countries that is not limited by government actions such as quotas, tariffs, and other taxes.

GATT (General Agreement on Tariffs and Trade): An international agreement intended to reduce trade barriers and encourage trade. GATT, established in 1947, was replaced by the WTO in 1995.

Globalization: The trend toward a single, worldwide market, without respect to national borders.

Imports/Exports

Imports: Goods and services bought from other countries for domestic use.

Exports: Goods and services produced in one country and sold to another country.

NAFTA (North American Free Trade Agreement): A 1993 agreement between Canada, the United States, and Mexico that will gradually eliminate most trade barriers between those countries.

Protectionism: Any policy designed to keep domestic industries from being hurt by competition from imports.

Protective tariff: A tax on imports designed to keep domestic producers from being hurt by competition from imports.

Quota/Tariff

Quota: A government limit on the amount of goods coming in from other countries.

Tariff: A tax on imports.

Trade barriers: Any government's use of taxes, tariffs, quotas, and other obstacles that make trade between countries more difficult or costly.

World Trade Organization (WTO): An international body that promotes free trade and resolves trade disputes between countries. The WTO was created in 1995 with the legal power to resolve a wide range of trade issues.

"The Terms of Trade" by CTB/McGraw-Hill editors.

1 Jesse wants to trace the movement toward a worldwide market. He wants to include the resolution of recent trade conflicts in his research paper. Under which heading should Jesse look?

A WTO
B GATT
C Protectionism
D Trade barriers

2 Trade barriers tend to have the hardest impact on the

A country importing the products.
B people buying the imported products.
C domestic industries selling the same products.
D international organization resolving trade disputes.

3 Jesse decides to support his paper's arguments with concrete examples of countries that are putting free trade agreements into practice. Which heading should Jesse first research at the library?

A Tariffs
B NAFTA
C Globalization
D Protectionism

4 What is the BEST way for Jesse to locate countries that have recently established trade barriers?

A by gathering information from the WTO
B by researching the history of the GATT
C by discovering more facts about free trade
D by investigating the theory of globalization

5 A tax on imported products is called

A a tariff.
B a quota.
C an export.
D a trade barrier.

6 Products that are brought from another country and used domestically are called

A tariffs.
B quotas.
C exports.
D imports.

7 What is the trend toward a worldwide market that has no national boundaries called?

A free trade
B trade barriers
C globalization
D protectionism

8 Which of the following is true about NAFTA's organization?

A It is the ultimate step toward globalization of the world.

B It is a move toward using tariffs to control other countries.

C It is an example of countries working together to lower trade barriers.

D It is an example of being able to change rules in a short period of time.

Read the following brochure and answer Numbers 1 through 10. You may look back at the brochure as often as you like.

You are about to take a vacation to Pensacola with your family. You have a brochure explaining some of the things you can do while there.

PARK IT . . .

. . . OUTDOORS. If you'd like to experience the natural side of the Pensacola area, you're welcome to camp, hike, or fish at Gulf Islands National Seashore, a 150-mile-long strip of barrier islands, harbors, and submerged land that's one of the most beautiful and well-preserved natural environments in the country. Established in 1971—with over 25 miles located in the Pensacola and Perdido Key area—it includes Santa Rosa Island (home of historic Fort Pickens and World War II batteries), and Naval Live Oaks Reservation, a 1,400-acre tract and seashore headquarters along Highway 98 in Gulf Breeze. The Gulf Islands National Seashore also contains an extraordinary collection of wildlife—including 280 different species of birds.

To the west, you can camp, hike, or picnic at Big Lagoon State Recreation Area located near Perdido Key on the Intracoastal Waterway. Birding, boating, concerts, and special night beach tours to view the sea turtles offer something for the whole family.

For a complete change of outdoor scenery, take a hike through the shady bayou at the Edward Ball Nature Preserve on the University of West Florida campus. Or head out to Bay Bluffs Park, where several elevated boardwalks give you a bird's-eye view of Florida's only scenic bluffs—a vista 20,000 years in the making!

GO WITH THE FLOW. Not far from Pensacola you'll find an area known as "The Canoe Capital of Florida." It contains the spring-fed streams of the Coldwater, Blackwater, and Sweetwater/Juniper creeks, which flow through state forests at a tranquil, relaxing pace.

Climb aboard a canoe, kayak, paddleboat, or inner tube, and leave your cares behind as you drift down the Perdido River or through the Blackwater River State Recreation Area, northeast of Pensacola.

On shore, cabins, campsites, nature trails, and picnic areas abound—especially at Adventures Unlimited, an 88-acre park (complete with even a ropes course) that's widely regarded as the center of all the action.

"Park It" from 1995–1996 *Official Pensacola Area Visitor's Guide*, copyright © 1996 by Pensacola Chamber of Commerce. Used by permission of the Pensacola Convention & Visitor's Center.

PARKS & TRAILS GUIDE Many of these items are based for the "on season" period only. For more information about seasonal changes refer to the phone numbers below this chart.	**Fort Pickens** Gulf Islands National Seashore	**Fort Barrancas** Gulf Islands National Seashore	**Naval Live Oak Reservation** Gulf Islands National Seashore	**Perdido Key Area Johnson Beach** Gulf Islands National Seashore	**Big Lagoon State Recreation Area**	**Perdido Key State Recreation Area**	**Blackwater River State Park**
Visitor's Center	○	○	○		○		
Museum	○						
Guided Tours	○	○					○
Picnic Area	○	○	○	○	○	○	○
Basic Camping	○				○		
Full Facility Camping	○				○		○
Youth Camping			○				
Cabin Rentals					○		○
Nature Trail	○	○	○		○		○
Biking	○	○	○	○	○	○	○
Swimming	○			○	○	○	○
Snorkeling	○			○	○		
Lifeguard	○			○			
Canoeing					○		○
Fishing	○			○	○		
Boat Ramp				○	○		○
Restrooms	○	○	○	○	○	○	○
Showers	○			○	○		
Concessions	○			○			
Handicap Access	○	○	○	○	○	○	○
Parking	○	○	○	○	○	○	○
Park Fee	○			○	○	○	○

Gulf Islands National Seashore 904-934-2600: *Fort Pickens, Fort Barrancas, Naval Live Oak Reservation, Perdido Key Area Johnson Beach*

Perdido Key State Recreation Area 904-492-1595

Big Lagoon State Recreation Area 904-492-1595

Blackwater River State Park 904-623-2363

"Trail Mix" from 1995–1996 *Official Pensacola Area Visitor's Guide*, copyright © 1996 by Pensacola Chamber of Commerce. Used by permission of the Pensacola Convention & Visitor's Center.

1 According to the chart, if campers want information about seasonal changes at a specific park or beach, they should telephone

A their travel agency.
B a historical society.
C that recreation area.
D the brochure publishers.

2 Campers who call one of the phone numbers below the Parks and Trails Guide are most likely seeking information about what kind of activities?

A winter
B summer
C on season
D off season

3 Which action shows that the chart was interpreted correctly?

A traveling to Fort Barrancas for fishing
B going to Naval Live Oak Reservation to rent a cabin
C hauling a boat to Perdido Key State Recreation Area
D arriving at Big Lagoon State Recreation Area with canoes

4 Which place has elevated boardwalks?

A Bay Bluffs Park
B Intracoastal Waterway
C Blackwater River State Park
D Big Lagoon State Recreation Area

5 In which park can you see sea turtles at night?

A Naval Live Oak Reservation
B Edward Ball Nature Preserve
C Big Lagoon State Recreation Area
D Perdido Key State Recreation Area

6 Where is Naval Live Oak Reservation?

A next to the Perdido Key area
B along Highway 98 in Gulf Breeze
C next to Gulf Islands National Seashore
D by Santa Rosa Island just outside of Pensacola

7 Which park has shower facilities?

A Fort Barrancas
B Naval Live Oak Reservation
C Blackwater River State Park
D Perdido Key Area Johnson Beach

8 How are the first and second parts of this brochure different?

A The first part promotes the features of parks; the second part lists factual information.
B The first part lists sequential details; the second part promotes the highlights of parks.
C The first part lists details; the second part contains chronological information about parks.
D The first part contains chronological information about parks; the second part describes various features.

9 How does the author support the statement that the Pensacola area is "one of the most beautiful and well-preserved natural environments in the country"?

A by listing recreational activities

B by naming state recreation areas

C by describing the scenery and wildlife

D by outlining the geographic boundaries

10 Why is an area near Pensacola referred to as "The Canoe Capital of Florida"?

A It has a long coastline.

B It is situated in a quiet harbor.

C It has many slow-moving streams.

D It is situated in the state forest system.

Read the following article and answer Numbers 1 through 7. You may look back at the article as often as you like.

SUSAN G. McBRIDE

VIDEO GAME DESIGNER

San Jose, California

WHAT I DO:

I come up with ideas for home computer video games, figure out how they would be played, and determine their basic graphic look. Then, I work with a team to fill out these designs. Right now my team includes another animator and a programmer, but we also get help from graphics, audio, and software support personnel. When I used to work on coin-operated arcade games, I worked on teams with two or three other programmers and up to five animators.

After getting an idea for a game, you produce story boards and thumbnail sketches that show how the new game will look. Then, once the concept is approved, you work out all the characters and the opponents, what the moment-to-moment action will be like, and how the controls will work. This stage includes producing working graphics and a model of the controls. When all that's finished, the concept is reviewed again and focus groups are held to estimate consumer reaction. Finally, the game is field tested.

Home games are different from coin-operated games. In coin-op games, you're trying to entice people to put their quarters into a machine. You know they're not going to play for long. But with home games, people own the cartridges, so you know they'll want to play the games for a long time. As a result, home games need to be more exploratory and graphically exciting. They're better suited to adventure formats than coin-op games.

HOW I GOT STARTED:

I came to this work by way of drawing. When I was a kid, I was always drawing. I drew my own comic books and illustrated T-shirts. In college, I almost double majored in graphic design and science. But I realized that what I really liked the most about biology was drawing the animals we worked with. So I decided to major exclusively in graphic design.

Graphic design led me in turn to animation and film. A film teacher of mine recommended me to Atari for a position involving computer graphics. He knew about the little characters I liked to animate and about an award-winning film that I made called *Mangia, Mangia, Mangia*. Done before Pac Man, it was about a little space creature that went around gobbling things up. I guess that my professor—and Atari—thought the film proved I was a natural for creating video games and characters.

HOW I FEEL ABOUT IT:

What I really like about working in the game industry is the chance to be creative and to come up with concepts that provide fun and entertainment for people. The games take people away from the world for a little while.

Each game is like a new beginning. You're creating a new world, and it's a thrill when it comes together. When you come up with an idea you love, you suddenly know it's going to be a hit, and that's very exciting.

"Video Game Designer" by Susan G. McBride from *Careers for Computer Buffs* by Andrew Kaplan, copyright © 1991 by The Millbrook Press. Used by permission.

WHAT YOU SHOULD KNOW:

There are a number of different routes into this business. You can come in as a programmer or, as I did, through animation. But even if your route is animation, you still need to get as much of a background in computers as you can.

To break in, you need to have a degree. Animators need to have a strong film background with a degree in something like film, animation, or art. Programmers need computer degrees. And after you're in, it's still a good idea to keep learning. Game designers need to have as much computer knowledge as they can. For example, although I'm already established in the industry, I'm getting additional software background and working toward a master's degree.

The pay varies. Some people get royalties, which can double or triple their salaries.

Another way to go is to open up your own house. Get an animator, a designer, a programmer, an engineer, and an audio person. Then develop games, sell them to companies, and get royalties. This arrangement offers you the potential to earn a lot of money.

To create these games, you need to enjoy children's culture and know what's going on with kids. Obviously, it helps to know what kids like to watch and the music they like to listen to. I go to science fiction conventions, arcades, and movies to keep up, and I also buy comic books and kids' magazines.

1 Information in the article is organized according to

A isolated blocks of information.

B separate sections with headings.

C steps explaining how to enter the field.

D important events in the author's career.

2 The author's main purpose in this article is to

A inspire.

B inform.

C entertain.

D persuade.

3 The next step after approval of a game concept is to

A field test the game.

B produce story boards.

C create a working model.

D estimate consumer reaction.

4 What convinced Atari of the author's creative abilities?

A her early drawings

B her job application

C her scientific sketches

D her award-winning film

5 When the author says, “Another way to go is to open up your own house,” she is comparing a working group to a

A team.

B family.

C school.

D neighborhood.

6 If the next subheading in this article were “WHERE WE’RE HEADED,” which of the following subjects would most likely be covered in that paragraph?

A the reader’s future needs

B the future of children’s culture

C the author’s plans for the future

D the future of video game design

7 Which set of statements BEST summarizes the author’s advice for entering and working in the video game design business?

A Obtain a master’s degree in computers and open your own design house. Develop your own games and then sell them to other companies.

B Pursue a double major in art and computers and form a team of developers. Sell your games to software companies and collect royalties.

C Major in animation and find a job that will teach you how to use computers. Improve your skills by taking night classes and attending children’s cultural events.

D Obtain a degree in an art-related field and learn as much as you can about computers. Continue to improve your skills and keep in touch with what kids are doing.

Read the following article and answer Numbers 1 through 9. You may look back at the article as often as you like.

DON SMALL

FLIGHT SIMULATOR

Houston, Texas

WHAT I DO:

Because I've been designing flight simulators for more than thirty-five years, I've worked on everything from airplane simulators to machines that simulate space flight. Right now, I'm working on a simulator for a space station.

To understand my work, you have to understand what a flight simulator is. A simulator's function is to prepare pilots, crew members, and astronauts for flight. When we design a simulator, we create a machine that will replicate[1] the trainee's future environment as closely as possible. The trainee uses the same controls found in the actual vehicle.

HOW I GOT STARTED:

I didn't start by pursuing a career in flight simulation. When I went to college, I began as a pre-med student. But I didn't like that side of science, so I moved into electronics.

After college, I got a job with a flight simulation company called Link. Link was just switching over from mechanical air trainers to electronic trainers, and they were recruiting electronics people like myself. I started as a field engineer, working in the factory to gain an understanding of the equipment. Then I went to the customers, trained them to use the equipment, and made any modifications that were necessary.

After that, I became involved with the space program. I worked on the Gemini mission simulator and other space flight simulators until 1969, when I moved to Houston to work with NASA on the Apollo program. After Apollo ended, I headed teams that built the simulator for the space shuttle.

HOW I FEEL ABOUT IT:

What's challenging about this work is that it explores every branch of science there is. We have to model the behavior of the real world so that what a person feels is exactly coordinated with what he or she hears and sees. That means really getting into a person's senses. To do this, you need a variety of engineering skills, and you must constantly call on all of your training and experience.

WHAT YOU SHOULD KNOW:

Today, most of the people we hire have computer science, electrical engineering, or physics degrees. Some even have simulation-related degrees. But even if you get one of these degrees, you still have to be trained as a systems engineer by Link or one of its competitors.

Normally, this is a regular eight-to-five job. However, there are times when you'll be working over sixty hours a week. This tends to occur either in the development cycle when things don't go as planned, or later during the space mission itself when something that wasn't anticipated happens. When I was working on Apollo 13, for example, one of the ship's tanks exploded on the way to the moon. I was part of a team that helped figure out a way to get the crew back before its supplies were exhausted. On that mission, I worked for thirty-six hours straight.

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[1] **replicate:** to duplicate or copy

"Flight Simulator" by Don Small from *Careers for Computer Buffs* by Andrew Kaplan, copyright © 1991 by The Millbrook Press. Used by permission.

1 A simulator for a space station is probably used to

A study conditions in space.
B launch the space shuttle into orbit.
C form a satellite link among nations.
D prepare astronauts for living in space.

2 What field of knowledge is MOST important for a flight simulation designer?

A graphics
B aeronautics
C psychology
D engineering

3 What makes a simulator different from other training methods?

A It reproduces actual conditions.
B It is used only for flight training.
C It is designed by professional trainers.
D It allows people to perform their jobs right away.

4 In the section titled "HOW I GOT STARTED," information is organized by

A date.
B skill.
C time.
D importance.

5 The author's experience with the flight simulation company probably

A prepared him to be a pilot.
B led him to pursue a degree in electronics.
C taught him a lot about the Apollo program.
D helped him get a position with the space program.

6 What does the author mean by "getting into a person's senses"?

A studying the physical effects of stress
B measuring the intelligence of humans
C controlling a person's thoughts and feelings
D understanding what a person is seeing and hearing

7 What is one of the common causes of long work hours in this field?

A unscheduled space launches
B team meetings to discuss future projects
C unexpected events during space missions
D special training to prepare new employees

8 The BEST way to prepare for a career in flight simulation design is to

A learn how to fly and train others.
B major in psychology or sociology.
C pursue a degree in engineering or science.
D receive on-the-job training in systems engineering.

9 Which statement BEST expresses the main idea of this article?

A This is a demanding job that requires intense preparation and training.

B This is an exciting job for people who like to work with others and make important decisions.

C This is a good job for people who like an eight-to-five schedule with few interruptions and little stress.

D This is a challenging job that calls upon all of your training and experience in a variety of scientific fields.

Read the following article and answer Numbers 1 through 9. You may look back at the article as often as you like.

Pollution's Hidden Toll on Native Plants

Nitrogen is an important plant nutrient, right? So when your car spews out nitrogen emissions into the environment and they settle onto the ground, are you enhancing plant growth? The answer may be yes, but, scientists are discovering, it's not the kind of growth that benefits native plants.

For 12 years, ecologists David A. Wedin of the University of Toronto and David Tilman of the University of Minnesota have applied nitrogen to 162 plots of native grasses at levels that approximate the amount of nitrogen that occurs in air-borne pollution from cars and power plants in the Northeast. Though plants need nitrogen to grow, the researchers found that the elevated nitrogen levels stimulated the growth of grasses imported from Europe while impairing the growth of native grasses.

This unusual situation apparently results from the way the two groups of plants use nutrients. Native grasses thrive in areas of relatively low nitrogen, while European interlopers imported for agricultural development need large doses of the nutrient. Once nitrogen increases in the soil, as when motor-vehicle pollution settles to the ground, non-native plants take over. Subsequent changes in the soil also increase nitrogen pollution in water supplies. In addition, species diversity in affected areas declines.

The news represents another blow to the nation's grasslands, which have declined considerably. What's more, observes Wedin, the disruptions caused by air-borne nitrogen may not be restricted only to grasslands, since the same effect is likely in other plant communities.

1 What is one important fact that researchers have found out about native grass plants?

A They require less attention.

B They require more nutrients.

C They require low levels of nitrogen.

D They require regular supplies of water.

2 How are increased levels of nitrogen beneficial?

A They enrich native plants.

B They stimulate imported grasses.

C They are good for water supplies.

D They are helpful for species diversity.

3 What is the meaning of the word *enhancing* as it is used in the first paragraph?

A creating

B decreasing

C stimulating

D illuminating

4 What effect does an increased level of nitrogen have on non-native grasses?

A It blocks nutrients.

B It stimulates growth.

C It activates diversity.

D It inhibits development.

"Pollution's Hidden Toll on Native Plants" from *National Wildlife*'s April/May 1997 issue, copyright © 1997 by National Wildlife Federation. Used by permission.

5 What is the meaning of the word *interlopers* as used in the third paragraph?

A visitors
B invaders
C achievers
D impostors

6 Read this sentence.

Though plants need nitrogen to grow, the researchers found that the elevated nitrogen levels stimulated the growth of grasses imported from Europe while impairing the growth of native grasses.

What is the meaning of the word *impairing* as it is used here?

A hastening
B damaging
C increasing
D disintegrating

7 How does a raised level of nitrogen in the soil affect the water supply?

A It increases pollution.
B It encourages oxygen.
C It activates organisms.
D It introduces nutrients.

8 Which idea from the article is not supported by evidence?

A Air-borne nitrogen is likely to disrupt other plant communities.
B Wedin and Tilman studied the effects of applied nitrogen for more than ten years.
C Air-borne nitrogen pollution from cars and power plants was approximated in a study.
D Changes in the amount of nitrogen in the soil change the amount of nitrogen in water supplies.

9 Which statement BEST summarizes the article?

A Scientists have discovered that when nitrogen levels in the soil increase, water supplies can become contaminated.
B Ecologists have discovered that air-borne nitrogen disrupts grassland growth and can affect plant communities in diverse areas.
C Ecologists have discovered that high levels of nitrogen cause non-native plants to grow while restricting the growth of native plants.
D Scientists have discovered that increased levels of nitrogen stimulate the growth of non-native plants but they also poison the water supply.

Read the following editorial and answer Numbers 1 through 11. You may look back at the editorial as often as you like.

Point of View on Advertising

by Andrew McFarland

Economists tell us that a healthy economy depends upon a healthy flow of goods and services. When people stop buying and selling, the economy goes into a tailspin. People become poor, and life becomes a barren struggle for survival at the subsistence level.

Someone who wants to sell something has to let people know what it is and how much it costs. A seller has to show wares and convince people that they need them. In other words, a seller has to advertise.

It has become fashionable recently to belabor advertising as a sinister plot to swindle the consumer and litter the countryside with huge piles of junk. Eye-catching, multicolored advertisements in slick magazines, as well as amusing commercials on TV, are decried as being not only insulting to the intelligence of the adult, but also, what's worse, damaging to the minds of children. Yet without them, both magazine publishers and television stations would go bankrupt, because advertisers contribute a major part of their revenue.

Another charge frequently made against the advertising industry is that advertising causes people to buy what they don't need or want. An unusual assertion indeed in a liberal democracy founded on the principle of free choice! This charge conjures up visions of a helpless citizenry enmeshed in a brainwashing mechanism. Search as you may, you will never find in American court records a single case of an innocent citizen being forced by advertisers or advertising into buying something he or she didn't want. Yes, *caveat emptor!* (let the buyer beware), but don't eliminate the sales pitch just because some people have bad judgment. Reflect for a moment on what this country would be today if it weren't for advertising.

Still other critics say that advertising contributes to pollution and is hastening the depletion of our raw materials. Because advertising is partly responsible for the flow of goods and services, this assertion may be true. But several other agents also contribute: the consumer who wants the goods, the manufacturer who profits by their production, the stockholder who wants a cut, the government that needs the tax money produced by the economy, and so on. Look back over this list and see where you fit in!

Next time you hear someone say that advertising has an adverse effect on the nation, remember that it is the catalyst in the essential buying-selling process.

"Point of View on Advertising" by CTB/McGraw-Hill editors.

1 How is this editorial organized?

A main idea supported by statistical examples

B critical ideas contradicted by logical statements

C a number of topics introduced for further development

D a number of topics considered, all of historical significance

2 Which technique does the author use to strengthen his argument about advertising?

A using personal testimonies

B giving statistics to show effectiveness

C addressing both positive and negative aspects

D describing advertisements that were successful

3 What method does the author use to convince the reader of his viewpoint?

A citing statistics

B quoting experts

C frightening the reader

D contradicting the critics

4 Which of the following ideas from the editorial is an example of faulty logic?

A To let people know what is for sale, sellers have to advertise.

B Without amusing commercials on TV, television stations would go bankrupt.

C You cannot take a company to court for selling something a buyer doesn't need.

D Manufacturers often contribute to pollution and hasten the depletion of our raw materials.

5 Read the following statement from the editorial.

Search as you may, you will never find in American court records a single case of an innocent citizen being forced by advertisers or advertising into buying something he or she didn't want.

Which phrase is used by the author to avoid a serious flaw in logic?

A "Search as you may"

B "an innocent citizen"

C "into buying something"

D "in American court records"

6 Which of the following ideas from the editorial is a FACT?

A Manufacturers profit by the production of goods.

B Most advertising is designed to brainwash people.

C Someone who wants to sell something must advertise.

D Television commercials damage the minds of children.

7 Which of the following ideas from the editorial is an OPINION?

A Advertising affects the flow of goods and services.

B Some magazines contain multicolored advertisements.

C Advertising causes consumers to buy items they do not need.

D Commercial television stations depend on advertising for revenue.

8 Read the following sentence.

Another charge frequently made against the advertising industry is that advertising causes people to buy what they don't need or want. An unusual assertion indeed . . .

What does the word *assertion* mean as used here?

A denial

B question

C statement

D predicament

9 According to the editorial, what would happen without advertising?

A Citizens would become wiser consumers.

B Farming would dominate economic decisions.

C Pollution and depletion of natural resources would increase.

D Exchange of goods and services would be drastically reduced.

10 Which of the following most accurately states the point of view of the author?

A Advertising contributes to pollution.

B Advertising is insulting to an intelligent adult.

C Advertising is an essential component of a healthy economy.

D Advertising causes people to buy things they don't want or need.

11 Advertising could hasten the depletion of raw materials by

A lowering environmental protection.

B causing inefficient production methods.

C generating over-consumption of products.

D providing excess profits to manufacturers.

Read the following article and answer Numbers 1 through 8. You may look back at the article as often as you like.

From Points to

Periods

(& commas, colons, dashes, ellipses, etc.):

by Pico Iyer

A Punctuation History

Imagine a world without commas or question marks. If that sounds great to you, you may wish you lived centuries ago, because punctuation as we know it today didn't always exist.

Greeks and Romans Get the Point

Both the Greeks and the Romans wrote without any separations between words; their inscriptions flowed in long, unbroken streams. The Latin word *punctus*, from which our word *punctuation* derives, simply means "point." And the first punctuation marks were just that—points placed between words in Greek and Latin texts to separate them. Later points were placed at different heights next to words to indicate places to pause or stop. The points didn't end sentences, or set off clauses, they simply gave some aid in reading aloud.

In fact, for centuries punctuation wasn't used to clarify grammar at all. It was used only to help people who were reading aloud figure out where to raise their voices, and where to slow down. The marks had nothing to do with meaning (so you were on your own if you needed to know a question from an exclamation).

Punctuation Heats Up

But things changed. In the 10th century, people started to write Latin with spaces between the words. An extra space at the end of a sentence became the rule, and a bigger letter was used at the beginnings of sentences and paragraphs. Parentheses showed up around 1500, and commas, periods, and semicolons were in use in Latin texts by the end of the 16th century.

By the end of the 17th century writers of English were using most of the marks of punctuation we're used to. However, the purpose of punctuation was still elocutionary, not syntactical.[1] The poet Ben Jonson was the first to recommend that punctuation marks be used to help readers figure out the meaning of a sentence, and not just how to recite it.

By the 18th century, writers of English had gone a little wild with punctuation, using commas to separate everything. It was Henry Watson Fowler and Francis George Fowler in *The King's English* (1906), who advocated easing up a bit. Our rules for correct punctuation still follow the guidelines that the Fowlers laid down.

Modern Rebels: Tom Wolfe and e.e. cummings

If, as the writer Pico Iyer states, punctuation has now become "a pillar that holds society upright," then an author's violation of the rules of punctuation can be a kind of rebellion. That does not mean that a writer ignores the rules, or makes unintentional mistakes. Instead, he or she both uses *and* breaks the rules to express meaning that can't be expressed in any other way. Poet e.e. cummings and journalist and novelist Tom Wolfe are two of the many writers whose work challenges the authority of the rules.

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[1] **syntactical:** of or relating to the rules for forming grammatical sentences

Adaptation of "From Points to Periods" from *Literary Cavalcade* Magazine's January 1997 issue, copyright © 1997 by Scholastic, Inc. Used by permission.

1 What is the author's purpose in writing this article?

A to promote the use of punctuation

B to explain the history of punctuation

C to demonstrate the rules of punctuation

D to illustrate the necessity of punctuation

2 How is the information in this article organized?

A events presented in the order they occurred

B general statements clarified by specific examples

C overall descriptions followed by detailed analyses

D definitions supported through references to authorities

3 In the development of punctuation, which appeared FIRST?

A points

B spaces

C ellipses

D semicolons

4 Read the following sentences from the article.

However, the purpose of punctuation was still elocutionary, not syntactical. The poet Ben Jonson was the first to recommend that punctuation marks be used to help readers figure out the meaning of a sentence, and not just how to recite it.

What is the meaning of *elocutionary* as it is used here?

A related to speaking publicly

B related to memorizing words

C related to arranging sentences

D related to understanding word meanings

5 Read the following sentence from the last paragraph under **"Punctuation Heats Up."**

It was Henry Watson Fowler and Francis George Fowler . . . who advocated easing up a bit.

What is the meaning of the word *advocated* as it is used in this paragraph?

A required

B continued

C discovered

D recommended

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6 What is the central thought of the section entitled **"Modern Rebels: Tom Wolfe and e.e. cummings"**?

A Writer Pico Iyer is a rebel who violated punctuation rules.

B Writers today mold punctuation to express themselves individually.

C Tom Wolfe and e.e. cummings have many punctuation mistakes in their works.

D The importance of punctuation in contemporary society should not be overlooked.

7 If the next subheading in the article were **"The Electronic Age,"** which of the following questions would most likely be answered in the paragraph?

A Has punctuation advanced the electronic revolution?

B Will the rules of punctuation change in the computer era?

C Has punctuation been made obsolete by the electronic age?

D Will computer software adjust to punctuation requirements?

8 Which set of statements BEST summarizes the article?

A Punctuation has evolved throughout history. The guidelines and rules we now use were introduced by the 18th century; however, some modern writers have been known to change the rules to fit their individual needs.

B Punctuation has changed very little from the days of the Greeks and Romans. Some of the same punctuation marks and guidelines used in the 16th century are still used today, causing some contemporary authors to challenge existing rules.

C The purpose of punctuation has remained constant although the punctuation marks themselves have changed. Therefore, some 20th century writers agree that to ignore these rules may be considered a type of rebellion against society.

D Punctuation was introduced to the world by the Greeks and the Romans. Until the 17th century the purpose of punctuation was not to clarify grammar, but to aid people in reading aloud. As the purpose of punctuation changed, so have the rules, and very few rules currently remain.

Read the following article and answer Numbers 1 through 5. You may look back at the article as often as you like.

The Globe Theater

THE GLOBE THEATER, a playhouse originally constructed in 1599 across the Thames River from London, England, has been rebuilt a second time. The reconstructed theater was opened officially in 1997.

The Globe, perhaps the most famous theater in history, was the scene of William Shakespeare's major plays, and two of his works about English kings bracketed its early years. The first, *Henry V*, christened the new theater; the second, *Henry VIII*, was playing in 1613 when a cannon, discharged at the entry of the king, set the thatched roof afire and completely destroyed the building. It was rebuilt in a year, but again tragically razed in 1644.

It was in the opening chorus of *Henry V* that Shakespeare referred to the theater as "this wooden O." His pride was justified, since he had been made a part owner of the building.

The original Globe was constructed by a syndicate headed by the Burbage brothers, Cuthbert and Richard. To build it, they tore down their previous playhouse, "The Theater," and transported the timber to the new site on carts. Luckily, it was an extremely cold winter, so the workmen were able to haul the material across the Thames, rather than using the crowded London Bridge.

The stage itself was ideally suited to the intimate, swiftly moving style of Elizabethan drama. The jutting forestage was used for general action. Behind it, there was a curtained-off area that could become a bedroom, as in *Othello*, or a cave, as in *The Tempest*. Above that was a gallery that was ideal for balcony scenes, and over that a smaller gallery for musicians. Above all was a false ceiling, known as "the Heavens." Permanent doors gave access on either side of the main stage; trap doors allowed for sudden appearances and disappearances.

The general audience, known as "groundlings," stood in the unroofed "yard" of the theater to watch the plays. A rough and rowdy bunch, they loved ghosts, sword fights, and amusing wordplay. Around them, in the galleries, the wealthier customers sat. The courtiers and gallants, for a higher price, were allowed to sit on the stage itself.

Rebuilding the famous playhouse was the dream of American actor Sam Wanamaker. In London, just after World War II, he tried to find the site of the theater and could locate nothing more than a metal plaque on a decrepit brewery. He spent the next 40 years finding the money and organizing the reconstruction of an exact replica of the old Globe, just a few yards from its original location. Now, tourists visiting London can put themselves in the shoes of those Elizabethan playgoers who cheered and jeered from the yard and galleries of the "wooden O."

1 Workmen were able to haul materials across the Thames River because

- **A** it was frozen over.
- **B** London Bridge had been built.
- **C** they had specialized equipment.
- **D** it was less crowded than London Bridge.

2 What is apparent from the seating arrangements at the Globe?

- **A** There was one ticket price for all.
- **B** The audience appreciated fine music.
- **C** Trap doors allowed for dramatic entrances.
- **D** There were distinctions among social classes.

"The Globe Theater" by CTB/McGraw-Hill editors.

3 What is the main idea of this article?

A The Globe Theater has a long history.

B The Globe Theater is now a tourist attraction.

C The Globe Theater has recently been rebuilt.

D The Globe Theater is currently owned by a syndicate.

4 What caused the Globe Theater to burn down?

A a cannon shot

B a rowdy patron

C the king's entry

D the wooden stage

5 Which set of statements BEST summarizes the article?

A The Globe is the most famous theater in history because Shakespeare's plays were performed there. It burned down and then was rebuilt a year later.

B The Globe's design made it the ideal theater for Shakespeare's plays. For this reason, it was reconstructed after many years and despite difficult problems.

C The Globe was originally constructed by the Burbage brothers on the site of an earlier playhouse. After years as the site of Shakespeare's plays, it was razed and then rebuilt.

D The Globe, where Shakespeare's plays were first performed, is possibly the most famous theater in history. A rebuilt version of it was opened in London after a period of reconstruction.

Read the following paragraph and bus schedule and answer Numbers 1 through 8. You may look back at the paragraph and bus schedule as often as you like.

Timothy is planning to take a bus trip over the winter break. He will be leaving from Mobile. He is looking at the schedule below to help him plan his trip.

BUSES LEAVING MOBILE

Destination	Bus Number	Departs	Arrives	Stops
Chattanooga, TN	46	9:45 a.m.	6:10 p.m.	None (EXPRESS)
Dalton, GA	498	10:01 a.m.	9:00 p.m.	Montgomery, AL
Glasgow, KY	73	10:15 a.m.	1:15 p.m.	None (EXPRESS)
Lexington, KY	575	12:30 p.m.	7:00 a.m.	Tuscaloosa, AL Chattanooga, TN
Carbondale, IL	109	3:25 p.m.	2:00 p.m.	Madisonville, KY

1 What is the number of the bus that will make the most stops before reaching its final destination?

A 46

B 498

C 575

D 109

2 What is the number of the bus that stops in Montgomery, Alabama, before it reaches its final destination?

A 498

B 73

C 575

D 109

3 To which of the following cities is there a nonstop bus from Mobile?

A Dalton, GA

B Glasgow, KY

C Lexington, KY

D Carbondale, IL

4 What can you determine about the buses labeled "EXPRESS"?

A These buses drive faster.

B These buses don't cost as much.

C These buses carry more passengers.

D These buses don't make any stops.

Paragraph and bus schedule by CTB/McGraw-Hill editors.

5 What time does the bus to Carbondale, IL, leave Mobile?

- **A** 10:01 a.m.
- **B** 10:15 a.m.
- **C** 12:30 p.m.
- **D** 3:25 p.m.

6 A friend asks Timothy which bus to take to travel from Mobile to Montgomery. What is the number of the bus he should take?

- **A** 46
- **B** 498
- **C** 73
- **D** 109

7 The information in the bus schedule is organized by

- **A** bus numbers numerically ordered.
- **B** transfer places ordered by distance.
- **C** destinations alphabetically ordered.
- **D** departure times chronologically ordered.

8 The bus schedule presents information in

- **A** related blocks of places and times.
- **B** separate columns with headings.
- **C** steps telling how to buy a ticket.
- **D** interesting sites to see en route.

ITEMS

BY

STANDARD AND OBJECTIVE

STANDARD I: The student will demonstrate literal understanding of passages taken from textual, functional, and recreational reading material.

OBJECTIVE

1. Identify supporting details.

ELIGIBLE CONTENT

- Identify details that support main idea(s) in one or more passages.

SAMPLE ITEMS

The item below references "Just Two Points Make One Dream Come True" on page 12.

1 Why does Fisher think it is funny when Dobbins wants to join the Wolverines?

* **A** Fisher's players are national champions.

B Fisher's players often become professionals.

C Fisher knows that Dobbins can't play basketball.

D Fisher thinks that Dobbins's scrapbook is comical.

The item below references "Park It" on page 24.

2 Which place has elevated boardwalks?

* **A** Bay Bluffs Park

B Intracoastal Waterway

C Blackwater River State Park

D Big Lagoon State Recreation Area

The item below references "Park It" on page 24.

3 In which park can you see sea turtles at night?

A Naval Live Oak Reservation

B Edward Ball Nature Preserve

* **C** Big Lagoon State Recreation Area

D Perdido Key State Recreation Area

The item below references "Park It" on page 24.

4 Where is Naval Live Oak Reservation?

A next to the Perdido Key area

* **B** along Highway 98 in Gulf Breeze

C next to Gulf Islands National Seashore

D by Santa Rosa Island just outside of Pensacola

The item below references "The Globe Theater" on page 42.

5 What caused the Globe Theater to burn down?

* **A** a cannon shot

B a rowdy patron

C the king's entry

D the wooden stage

The item below references "Flight Simulator" on page 31.

6 The BEST way to prepare for a career in flight simulation design is to

A learn how to fly and train others.

B major in psychology or sociology.

* **C** pursue a degree in engineering or science.

D receive on-the-job training in systems engineering.

The item below references "Flight Simulator" on page 31.

7 What field of knowledge is MOST important for a flight simulation designer?

A graphics

B aeronautics

C psychology

* **D** engineering

The item below references "Pollution's Hidden Toll on Native Plants" on page 34.

8 How are increased levels of nitrogen beneficial?

A They enrich native plants.

* **B** They stimulate imported grasses.

C They are good for water supplies.

D They are helpful for species diversity.

The item below references "Pollution's Hidden Toll on Native Plants" on page 34.

9 What is one important fact that researchers have found out about native grass plants?

A They require less attention.

B They require more nutrients.

* **C** They require low levels of nitrogen.

D They require regular supplies of water.

The item below references "Postal Delivery Time Line" on page 19.

10 When did the first mail travel by air?

A in 1920

B in 1918

C in the 1700s

* **D** in 1000 B.C.

The item below references "Saga of a Seagoing Dog" on page 15.

11 What was the author's reaction to the loss of Santos?

A anger

B optimism

C happiness

* **D** discouragement

The item below references "Saga of a Seagoing Dog" on page 15.

12 The puppy came to the family when

A Dorothy got lost in the fog off the Bahamas.

* **B** a couple offered them their choice of a litter.

C Santos was working as a canal dog in Europe.

D a fisherman found him swimming near a fishing tournament.

The item below references "The Terms of Trade" on page 21.

13 Which of the following is true about NAFTA's organization?

A It is the ultimate step toward globalization of the world.

B It is a move toward using tariffs to control other countries.

* **C** It is an example of countries working together to lower trade barriers.

D It is an example of being able to change rules in a short period of time.

The item below references "Dorothy Parker" on page 7.

14 When Dorothy Parker wrote, "Dear God, please make me stop writing like a woman," she meant she would rather write

A with a masculine style.

B without using her wit.

C about something she knows.

* **D** about something other than romantic love.

STANDARD I: The student will demonstrate literal understanding of passages taken from textual, functional, and recreational reading material.

OBJECTIVE

2. Determine sequence of events.

ELIGIBLE CONTENT

- Identify sequential order in one or more passages. (Note: Sequential order may include dates; first, next, last; before and after; and order of events.)

SAMPLE ITEMS

The item below references "Dorothy Parker" on page 7.

1 How did Dorothy Parker begin her career as a writer?

* **A** as a copywriter for *Vogue*
B as a student at convent school
C as a drama critic for *Vanity Fair*
D as a member of the Algonquin Round Table

The item below references "In and of Ourselves We Trust" on page 10.

2 When does Andy Rooney decide that he stopped at the red light "because it's part of a contract we all have with each other"?

* **A** after he goes to bed
B while braking for the light
C during his wait at the light
D before he reaches Lewisburg

The item below references "Saga of a Seagoing Dog" on page 15.

3 What did Santos do when he FIRST arrived on the boat?

A He fell overboard.
* **B** He growled at the author.
C He barked at a nearby fishing boat.
D He whimpered as he smelled the wind.

The item below references "From Points to Periods" on page 39.

4 In the development of punctuation, which appeared FIRST?

* **A** points
B spaces
C ellipses
D semicolons

The item below references “Video Game Designer” on page 28.

5 The next step after approval of a game concept is to

A field test the game.

B produce story boards.

* **C** create a working model.

D estimate consumer reaction.

STANDARD I: The student will demonstrate literal understanding of passages taken from textual, functional, and recreational reading material.

OBJECTIVE

3. Follow directions.

ELIGIBLE CONTENT

- Identify directions that are implicit or embedded in a passage.
- Identify the outcome or product of a set of directions.
- Recognize when a set of directions has been followed correctly.

Note: Directions will relate to activities that are appropriate for Grade 11 students.

SAMPLE ITEMS

The item below references "Park It" on page 24.

1 According to the chart, if campers want information about seasonal changes at a specific park or beach, they should telephone

A their travel agency.

B a historical society.

* **C** that recreation area.

D the brochure publishers.

The item below references "Park It" on page 24.

2 Campers who call one of the phone numbers below the Parks and Trails Guide are most likely seeking information about what kind of activities?

A winter

B summer

C on season

* **D** off season

The item below references "Park It" on page 24.

3 Which action shows that the chart was interpreted correctly?

A traveling to Fort Barrancas for fishing

B going to Naval Live Oak Reservation to rent a cabin

C hauling a boat to Perdido Key State Recreation Area

* **D** arriving at Big Lagoon State Recreation Area with canoes

STANDARD II: The student will interpret passages taken from textual, functional, and recreational reading material.

OBJECTIVE

1. Identify main idea.

ELIGIBLE CONTENT

- Recognize the main idea in a paragraph or passage(s). (Note: Main idea may include topic, subject, theme, central thought or message, lesson or moral, thesis, and author's purpose and/or point of view.)

SAMPLE ITEMS

The item below references "The Globe Theater" on page 42.

1 What is the main idea of this article?

* **A** The Globe Theater has a long history.

B The Globe Theater is now a tourist attraction.

C The Globe Theater has recently been rebuilt.

D The Globe Theater is currently owned by a syndicate.

The item below references "Flight Simulator" on page 31.

2 Which statement BEST expresses the main idea of this article?

A This is a demanding job that requires intense preparation and training.

B This is an exciting job for people who like to work with others and make important decisions.

C This is a good job for people who like an eight-to-five schedule with few interruptions and little stress.

* **D** This is a challenging job that calls upon all of your training and experience in a variety of scientific fields.

The item below references "Just Two Points Make One Dream Come True" on page 12.

3 What is a major theme in this story?

- * **A** It takes commitment to reach a goal.
- **B** It takes conviction to sit on the bench.
- **C** It takes persistence to get an education.
- **D** It takes concentration to make a basket.

The item below references "In and of Ourselves We Trust" on page 10.

4 What is the main idea of this newspaper column?

- * **A** We must trust each other in order to have a stable society.
- **B** We stop at red lights because we obey social conventions.
- **C** We should pay our taxes even when we don't agree with the government.
- **D** We tell others about our honesty so they will be more likely to follow the rules.

The item below references "From Points to Periods" on page 39.

5 What is the author's purpose in writing this article?

- **A** to promote the use of punctuation
- * **B** to explain the history of punctuation
- **C** to demonstrate the rules of punctuation
- **D** to illustrate the necessity of punctuation

The item below references "From Points to Periods" on page 39.

6 What is the central thought of the section entitled **"Modern Rebels: Tom Wolfe and e.e. cummings"**?

- **A** Writer Pico Iyer is a rebel who violated punctuation rules.
- * **B** Writers today mold punctuation to express themselves individually.
- **C** Tom Wolfe and e.e. cummings have many punctuation mistakes in their works.
- **D** The importance of punctuation in contemporary society should not be overlooked.

The item below references "Dorothy Parker" on page 7.

7 The main idea of this article is that Dorothy Parker

- **A** lost her sense of humor at the end of her life.
- **B** is best known for her screenplay *A Star Is Born.*
- **C** often wished that she could write without using humor.
- * **D** is famous for both her wit and her insightful tales of love.

The item below references "Postal Delivery Time Line" on page 19.

8 Which phrase BEST describes the main idea of this time line?

A an in-depth history of the postal service

B an international tribute to the postal service

C a detailed history of technological advances in the postal service

* **D** a chronological list of important events concerning the postal service

The item below references "Video Game Designer" on page 28.

9 The author's main purpose in this article is to

A inspire.

* **B** inform.

C entertain.

D persuade.

STANDARD II: The student will interpret passages taken from textual, functional, and recreational reading material.

OBJECTIVE

2. Draw conclusions.

ELIGIBLE CONTENT

- Draw conclusions based on information in one or more passages.

SAMPLE ITEMS

The item below references "Dorothy Parker" on page 7.

1 What can the reader conclude about Dorothy Parker's time in school?

A She learned many practical skills.

* **B** She cared little about her education.

C She wrote many humorous essays that got her in trouble.

D She learned everything she needed to know to become a great writer.

The item below references "Dorothy Parker" on page 7.

2 What can the reader conclude from the poem about Dorothy Parker's attitude toward roses?

A She appreciates roses as examples of perfection.

B She believes roses symbolize a romantic relationship.

C She thinks roses are a poor substitute for time spent traveling.

* **D** She feels roses are fine but she would like something more substantial.

The item below references "Dorothy Parker" on page 7.

3 Which part of the poem demonstrates Dorothy Parker's wit?

A "A single flow'r he sent me, since we met."

B "Deep-hearted, pure, with scented dew still wet—"

C "Love long has taken for his amulet/One perfect rose."

* **D** "Why is it no one ever sent me yet/One perfect limousine?"

The item below references "Flight Simulator" on page 31.

4 What makes a simulator different from other training methods?

* **A** It reproduces actual conditions.

B It is used only for flight training.

C It is designed by professional trainers.

D It allows people to perform their jobs right away.

The item below references "Flight Simulator" on page 31.

5 A simulator for a space station is probably used to

A study conditions in space.
B launch the space shuttle into orbit.
C form a satellite link among nations.
* **D** prepare astronauts for living in space.

The item below references "In and of Ourselves We Trust" on page 10.

6 What can you conclude about Andy Rooney from this newspaper column?

A He believes most people mistrust others.
* **B** He considers himself a law-abiding citizen.
C He thinks that he is perfect.
D He trusts the Internal Revenue Service.

The item below references "In and of Ourselves We Trust" on page 10.

7 Rooney's statement "We do what we say we'll do. We show up when we say we'll show up" supports his belief that Americans are

A proud.
B prompt.
* **C** trustworthy.
D complacent.

The item below references "Just Two Points Make One Dream Come True" on page 12.

8 What is the attitude of the Wolverines towards Dobbins?

A lenient
B tolerant
* **C** admiring
D flattering

The item below references "The Terms of Trade" on page 21.

9 Trade barriers tend to have the hardest impact on the

A country importing the products.
* **B** people buying the imported products.
C domestic industries selling the same products.
D international organization resolving trade disputes.

The item below references "The Globe Theater" on page 42.

10 What is apparent from the seating arrangements at the Globe?

A There was one ticket price for all.
B The audience appreciated fine music.
C Trap doors allowed for dramatic entrances.
* **D** There were distinctions among social classes.

The item below references "Postal Delivery Time Line" on page 19.

11 Which date indicates the first effect of scientific advances on the delivery of the mail?

A 1639

* B 1813

C 1832

D 1918

The item below references "Postal Delivery Time Line" on page 19.

12 What might be seen as a major trend in postal service?

* A speeding up the time of delivery

B making stamps attractive to collectors

C offering service to the common people

D providing increased security for postal customers

The item below references "Saga of a Seagoing Dog" on page 15.

13 Schipperkes helped barges navigate the canals by

A swimming alongside the barges.

B smelling the thick fog to locate land.

C alerting the captain of passengers overboard.

* D encouraging tow horses to continue walking.

The item below references "Saga of a Seagoing Dog" on page 15.

14 When the author first met the dog, Santos seemed

A cheerful.

B miserable.

* C unfriendly.

D affectionate.

The item below references "Saga of a Seagoing Dog" on page 15.

15 Why did Diego tear open the "last package of tortilla chips, crackling the bag noisily"?

A to help in the preparation of lunch

B to offer some food to the port captain

* C to tempt the dog to come out of hiding

D to encourage the family to eat before leaving

The item below references "Park It" on page 24.

16 Why is an area near Pensacola referred to as "The Canoe Capital of Florida"?

A It has a long coastline.

B It is situated in a quiet harbor.

* C It has many slow-moving streams.

D It is situated in the state forest system.

STANDARD II: The student will interpret passages taken from textual, functional, and recreational reading material.

OBJECTIVE

3. Determine cause and effect.

ELIGIBLE CONTENT

- Infer the cause(s) of effect(s) stated or implied in a passage.
- Infer the effect(s) of cause(s) stated or implied in a passage.

SAMPLE ITEMS

The item below references "Flight Simulator" on page 31.

1 The author's experience with the flight simulation company probably

A prepared him to be a pilot.

B led him to pursue a degree in electronics.

C taught him a lot about the Apollo program.

* **D** helped him get a position with the space program.

The item below references "Flight Simulator" on page 31.

2 What is one of the common causes of long work hours in this field?

A unscheduled space launches

B team meetings to discuss future projects

* **C** unexpected events during space missions

D special training to prepare new employees

The item below references "Just Two Points Make One Dream Come True" on page 12.

3 What happens because Dobbins shows his scrapbook to Fisher?

* **A** Dobbins makes the team.

B Dobbins sits in the stands.

C Dobbins drives to Atlanta.

D Dobbins plays his first game.

The item below references "Just Two Points Make One Dream Come True" on page 12.

4 What happens to Dobbins because Michigan recruits the Fab Five?

A He joins an opposing team.

B He drives to different cities.

C He is traded to another team.

* **D** He is dropped from the team.

The item below references "The Globe Theater" on page 42.

5 Workmen were able to haul materials across the Thames River because

- * **A** it was frozen over.
- **B** London Bridge had been built.
- **C** they had specialized equipment.
- **D** it was less crowded than London Bridge.

The item below references "Pollution's Hidden Toll on Native Plants" on page 34.

6 How does a raised level of nitrogen in the soil affect the water supply?

- * **A** It increases pollution.
- **B** It encourages oxygen.
- **C** It activates organisms.
- **D** It introduces nutrients.

The item below references "Pollution's Hidden Toll on Native Plants" on page 34.

7 What effect does an increased level of nitrogen have on non-native grasses?

- **A** It blocks nutrients.
- * **B** It stimulates growth.
- **C** It activates diversity.
- **D** It inhibits development.

The item below references "Video Game Designer" on page 28.

8 What convinced Atari of the author's creative abilities?

- **A** her early drawings
- **B** her job application
- **C** her scientific sketches
- * **D** her award-winning film

The item below references "Point of View on Advertising" on page 36.

9 Advertising could hasten the depletion of raw materials by

- **A** lowering environmental protection.
- **B** causing inefficient production methods.
- * **C** generating over-consumption of products.
- **D** providing excess profits to manufacturers.

STANDARD II: The student will interpret passages taken from textual, functional, and recreational reading material.

OBJECTIVE

4. Detect propaganda; distinguish fact from opinion.

ELIGIBLE CONTENT

- Identify an author's purpose or point of view in one or more passages.
- Identify vocabulary or other uses of language that are intended to persuade or influence the reader to agree or disagree with a point of view and/or take a particular action.
- Identify the purpose of specific persuasive techniques, but not label or define the techniques.
- Distinguish facts from opinions based on a passage.

SAMPLE ITEMS

The item below references "Point of View on Advertising" on page 36.

1 Which of the following ideas from the editorial is a FACT?

* **A** Manufacturers profit by the production of goods.

B Most advertising is designed to brainwash people.

C Someone who wants to sell something must advertise.

D Television commercials damage the minds of children.

The item below references "Point of View on Advertising" on page 36.

2 According to the editorial, what would happen without advertising?

A Citizens would become wiser consumers.

B Farming would dominate economic decisions.

C Pollution and depletion of natural resources would increase.

* **D** Exchange of goods and services would be drastically reduced.

The item below references "Point of View on Advertising" on page 36.

3 Which of the following most accurately states the point of view of the author?

A Advertising contributes to pollution.

B Advertising is insulting to an intelligent adult.

* C Advertising is an essential component of a healthy economy.

D Advertising causes people to buy things they don't want or need.

The item below references "Point of View on Advertising" on page 36.

4 What method does the author use to convince the reader of his viewpoint?

A citing statistics

B quoting experts

C frightening the reader

* D contradicting the critics

The item below references "Point of View on Advertising" on page 36.

5 Which of the following ideas from the editorial is an OPINION?

A Advertising affects the flow of goods and services.

B Some magazines contain multicolored advertisements.

* C Advertising causes consumers to buy items they do not need.

D Commercial television stations depend on advertising for revenue.

The item below references "In and of Ourselves We Trust" on page 10.

6 Why does Rooney change from "I" to "we" about halfway through the newspaper column?

A to urge readers to obey traffic laws

B to enable readers to understand the social contract

* C to encourage readers to identify with his point of view

D to lead readers to consider conventions more important than laws

STANDARD II: The student will interpret passages taken from textual, functional, and recreational reading material.

OBJECTIVE

5. Recognize statements that adequately summarize a passage.

ELIGIBLE CONTENT

None specified.

SAMPLE ITEMS

The item below references "Pollution's Hidden Toll on Native Plants" on page 34.

1 Which statement BEST summarizes the article?

A Scientists have discovered that when nitrogen levels in the soil increase, water supplies can become contaminated.

B Ecologists have discovered that air-borne nitrogen disrupts grassland growth and can affect plant communities in diverse areas.

* **C** Ecologists have discovered that high levels of nitrogen cause non-native plants to grow while restricting the growth of native plants.

D Scientists have discovered that increased levels of nitrogen stimulate the growth of non-native plants but they also poison the water supply.

The item below references "In and of Ourselves We Trust" on page 10.

2 Which set of statements BEST summarizes this newspaper column?

A The Internal Revenue Service needs to enforce stronger tax laws. Otherwise, no one will pay taxes.

* **B** The stability of society is built on trust. Without trust the contract we have with each other would be destroyed.

C If we did not trust each other, there would be a tax revolt. The contract we have with each other would be destroyed.

D Through trusting each other to obey laws, we build a solid government. We must have a strong police force in order to ensure that stability.

The item below references "From Points to Periods" on page 39.

3 Which set of statements BEST summarizes the article?

* **A** Punctuation has evolved throughout history. The guidelines and rules we now use were introduced by the 18th century; however, some modern writers have been known to change the rules to fit their individual needs.

B Punctuation has changed very little from the days of the Greeks and Romans. Some of the same punctuation marks and guidelines used in the 16th century are still used today, causing some contemporary authors to challenge existing rules.

C The purpose of punctuation has remained constant although the punctuation marks themselves have changed. Therefore, some 20th century writers agree that to ignore these rules may be considered a type of rebellion against society.

D Punctuation was introduced to the world by the Greeks and the Romans. Until the 17th century the purpose of punctuation was not to clarify grammar, but to aid people in reading aloud. As the purpose of punctuation changed, so have the rules, and very few rules currently remain.

The item below references "Video Game Designer" on page 28.

4 Which set of statements BEST summarizes the author's advice for entering and working in the video game design business?

A Obtain a master's degree in computers and open your own design house. Develop your own games and then sell them to other companies.

B Pursue a double major in art and computers and form a team of developers. Sell your games to software companies and collect royalties.

C Major in animation and find a job that will teach you how to use computers. Improve your skills by taking night classes and attending children's cultural events.

* **D** Obtain a degree in an art-related field and learn as much as you can about computers. Continue to improve your skills and keep in touch with what kids are doing.

The item below references "Just Two Points Make One Dream Come True" on page 12.

5 Which set of statements BEST summarizes the story?

A Sean Dobbins wanted to score a two-point basket during his college basketball career. He scored with a free throw during his sophomore year but still wanted a two-point basket. Even though he never got to play, his teammates loved his spirit.

* B Sean Dobbins dreamed of making a two-point basket during his college basketball career. Through a number of circumstances, he almost lost out on that dream. But in his senior year he finally realized his goal when he scored a basket in the final seconds of a tournament game.

C Sean Dobbins wanted to make a basket during his college basketball career. Even though he scored with a free throw, it was not good enough. He thought that he had two years left in which to score a basket. But unfortunately he had to leave the team when the Fab Five were recruited.

D Sean Dobbins was able to get on the Wolverines team by showing his high school scrapbook to the coach. He played for two seasons but had to leave the team in his junior year when the Fab Five were recruited. He never lost his enthusiasm and got a chance to play again with the team in his senior year.

The item below references "Saga of a Seagoing Dog" on page 15.

6 Which set of statements BEST summarizes the story?

A Santos repeatedly falls or jumps overboard but is returned each time to his family's sailboat. One time he is lost off South America but is brought back by a port captain.

* B The author reluctantly accepts a puppy onboard his sailboat. The dog, intelligent and full of fun, endears himself to the family and has a variety of adventures on and off the boat.

C *Breath*, the family sailboat, becomes the home of a happy, adventurous dog. At the end of the story, Santos jumps overboard to play on shore with another dog and some children.

D A family adopts a schipperke puppy that was bred to be aboard a boat and help with navigation. As a puppy, Santos falls overboard twice; one of those times he comes back to the family with a skin diver.

The item below references "The Globe Theater" on page 42.

7 Which set of statements BEST summarizes the article?

A The Globe is the most famous theater in history because Shakespeare's plays were performed there. It burned down and then was rebuilt a year later.

B The Globe's design made it the ideal theater for Shakespeare's plays. For this reason, it was reconstructed after many years and despite difficult problems.

C The Globe was originally constructed by the Burbage brothers on the site of an earlier playhouse. After years as the site of Shakespeare's plays, it was razed and then rebuilt.

* **D** The Globe, where Shakespeare's plays were first performed, is possibly the most famous theater in history. A rebuilt version of it was opened in London after a period of reconstruction.

STANDARD III: The student will apply critical analysis strategies and judge texts critically to comprehend passages from textual, functional, and recreational reading material.

OBJECTIVE

1. Recognize fallacies of logic and judge strength of argument.

ELIGIBLE CONTENT

- Recognize faulty logic in one or more passages.
- Evaluate faulty logic in one or more passages.
- Recognize the strength(s) or weakness(es) of argument(s) in one or more passages.
- Evaluate the strength(s) or weakness(es) of argument(s) in one or more passages.
- Recognize terminology used by an author to strengthen argument(s), but not label or define the terminology.

SAMPLE ITEMS

The item below references "Point of View on Advertising" on page 36.

1 Which of the following ideas from the editorial is an example of faulty logic?

A To let people know what is for sale, sellers have to advertise.

* **B** Without amusing commercials on TV, television stations would go bankrupt.

C You cannot take a company to court for selling something a buyer doesn't need.

D Manufacturers often contribute to pollution and hasten the depletion of our raw materials.

The item below references "Point of View on Advertising" on page 36.

2 Read the following statement from the editorial.

Search as you may, you will never find in American court records a single case of an innocent citizen being forced by advertisers or advertising into buying something he or she didn't want.

Which phrase is used by the author to avoid a serious flaw in logic?

A "Search as you may"

B "an innocent citizen"

C "into buying something"

* **D** "in American court records"

The item below references "Point of View on Advertising" on page 36.

3 Which technique does the author use to strengthen his argument about advertising?

A using personal testimonies

B giving statistics to show effectiveness

* **C** addressing both positive and negative aspects

D describing advertisements that were successful

The item below references "In and of Ourselves We Trust" on page 10.

4 What is the most convincing reason Rooney gives for not going through the red light?

A It is against the law.

B We just don't go through red lights.

* **C** It is part of a contract we have with each other.

D We stop in this situation because it makes us feel proud.

The item below references "Pollution's Hidden Toll on Native Plants" on page 34.

5 Which idea from the article is not supported by evidence?

* **A** Air-borne nitrogen is likely to disrupt other plant communities.

B Wedin and Tilman studied the effects of applied nitrogen for more than ten years.

C Air-borne nitrogen pollution from cars and power plants was approximated in a study.

D Changes in the amount of nitrogen in the soil change the amount of nitrogen in water supplies.

The item below references "Postal Delivery Time Line" on page 19.

6 If Leann wants to make the point that mail delivery was often difficult, which fact would be BEST to include in her research paper?

A In 1896, Rural Free Delivery of mail began.

B In 1963, Zip Code numbers were put into use.

* **C** In 1799, Congress passed a death penalty for robbing the mail.

D In 1941, a post office on wheels, called Highway Post Office (HYPO), was initiated.

The item below references "Park It" on page 24.

7 How does the author support the statement that the Pensacola area is "one of the most beautiful and well-preserved natural environments in the country"?

A by listing recreational activities

B by naming state recreation areas

* **C** by describing the scenery and wildlife

D by outlining the geographic boundaries

STANDARD III: The student will apply critical analysis strategies and judge texts critically to comprehend passages from textual, functional, and recreational reading material.

OBJECTIVE

2. Analyze literary elements.

ELIGIBLE CONTENT

- Analyze literary elements as they relate to the comprehension of a passage, but not label or define the elements. (Note: Literary elements are limited to theme, character, tone, setting, mood, plot, and literary point of view.)

SAMPLE ITEMS

The item below references "Dorothy Parker" on page 7.

1 What is the theme of the poem?

A Love will last no matter what gifts are given.

* **B** Women desire more than symbolism in a gift.

C Love should be shown through inexpensive gifts.

D Women know a single rose is a better gift than jewelry.

The item below references "Dorothy Parker" on page 7.

2 What is the tone of the poem?

A angry

* **B** ironic

C tender

D dramatic

The item below references "Saga of a Seagoing Dog" on page 15.

3 What is the tone of this story?

A nostalgic regret

B harsh irritation

* **C** gentle amusement

D sarcastic mockery

The item below references "Just Two Points Make One Dream Come True" on page 12.

4 What word BEST describes Dobbins's character?

A critical

B humorous

C pessimistic

* **D** determined

The item below references "Just Two Points Make One Dream Come True" on page 12.

5 What method does the author use to dramatize the final scene of his story?

- A He interviews the coach.
- * B He quotes two ballplayers.
- C He mentions the scrapbook.
- D He discusses team motivation.

STANDARD III: The student will apply critical analysis strategies and judge texts critically to comprehend passages from textual, functional, and recreational reading material.

OBJECTIVE

3. Demonstrate understanding of figurative language and analogy.

ELIGIBLE CONTENT

- Analyze the use of analogy in a passage.
- Analyze how figurative language enhances the comprehension of passages, but not label or define the figurative language. (Note: Types of figurative language are limited to simile, imagery, metaphor, personification, and hyperbole [overstatement].)

SAMPLE ITEMS

The item below references "Dorothy Parker" on page 7.

1 Who or what is the messenger in the line, "All tenderly his messenger he chose"?

* **A** flower

B limousine

C amulet

D heart

The item below references "Flight Simulator" on page 31.

2 What does the author mean by "getting into a person's senses"?

A studying the physical effects of stress

B measuring the intelligence of humans

C controlling a person's thoughts and feelings

* **D** understanding what a person is seeing and hearing

The item below references "Video Game Designer" on page 28.

3 When the author says, "Another way to go is to open up your own house," she is comparing a working group to a

A team.

* **B** family.

C school.

D neighborhood.

STANDARD IV: The student will utilize strategies that enhance comprehension of textual, functional, and recreational reading material.

OBJECTIVE

1. Determine word meaning through the use of context clues.

ELIGIBLE CONTENT

- Determine the meaning of words or phrases in context. (Note: Target words or phrases may include uncommon meanings of common words or phrases; specialized or technical vocabulary; and words or phrases that might be unfamiliar to most Grade 11 students.)

SAMPLE ITEMS

The item below references "Pollution's Hidden Toll on Native Plants" on page 34.

1 What is the meaning of the word *interlopers* as used in the third paragraph?

A visitors
* **B** invaders
C achievers
D impostors

The item below references "Pollution's Hidden Toll on Native Plants" on page 34.

2 What is the meaning of the word *enhancing* as it is used in the first paragraph?

A creating
B decreasing
* **C** stimulating
D illuminating

The item below references "Pollution's Hidden Toll on Native Plants" on page 34.

3 Read this sentence.

Though plants need nitrogen to grow, the researchers found that the elevated nitrogen levels stimulated the growth of grasses imported from Europe while impairing the growth of native grasses.

What is the meaning of the word *impairing* as it is used here?

A hastening
* **B** damaging
C increasing
D disintegrating

The item below references "Point of View on Advertising" on page 36.

4 Read the following sentence.

Another charge frequently made against the advertising industry is that advertising causes people to buy what they don't need or want. An unusual assertion indeed . . .

What does the word *assertion* mean as used here?

A denial

B question

* **C** statement

D predicament

The item below references "Saga of a Seagoing Dog" on page 15.

5 Read the following sentence from the story.

He had been an endlessly amusing little rogue.

What does the word *rogue* mean as it is used here?

* **A** rascal

B friend

C stranger

D monster

The item below references "Saga of a Seagoing Dog" on page 15.

6 What does the author probably mean by the word *unbidden* when he writes that Santos "would creep unbidden into the lonely helmsman's lap"?

A not aided

* **B** not invited

C not ashamed

D not observed

The item below references "From Points to Periods" on page 39.

7 Read the following sentence from the last paragraph under **"Punctuation Heats Up."**

It was Henry Watson Fowler and Francis George Fowler . . . who advocated easing up a bit.

What is the meaning of the word *advocated* as it is used in this paragraph?

A required

B continued

C discovered

* **D** recommended

The item below references "From Points to Periods" on page 39.

8 Read the following sentences from the article.

However, the purpose of punctuation was still elocutionary, not syntactical. The poet Ben Jonson was the first to recommend that punctuation marks be used to help readers figure out the meaning of a sentence, and not just how to recite it.

What is the meaning of *elocutionary* as it is used here?

* **A** related to speaking publicly

B related to memorizing words

C related to arranging sentences

D related to understanding word meanings

STANDARD IV: The student will utilize strategies that enhance comprehension of textual, functional, and recreational reading material.

OBJECTIVE

2. Demonstrate the ability to preview and predict.

ELIGIBLE CONTENT

- Preview text features to make a prediction about the text content. (Note: Text features may include headings, subheadings, illustrations, footnotes, captions, topic sentences, book jackets, introductory paragraphs, and such graphic displays as charts, maps, graphs, and timelines.)

SAMPLE ITEMS

The item below references "Video Game Designer" on page 28.

1 If the next subheading in this article were "WHERE WE'RE HEADED," which of the following subjects would most likely be covered in that paragraph?

A the reader's future needs

B the future of children's culture

C the author's plans for the future

* **D** the future of video game design

The item below references "From Points to Periods" on page 39.

2 If the next subheading in the article were **"The Electronic Age,"** which of the following questions would most likely be answered in the paragraph?

A Has punctuation advanced the electronic revolution?

* **B** Will the rules of punctuation change in the computer era?

C Has punctuation been made obsolete by the electronic age?

D Will computer software adjust to punctuation requirements?

STANDARD IV: The student will utilize strategies that enhance comprehension of textual, functional, and recreational reading material.

OBJECTIVE

3. Discern organizational patterns.

ELIGIBLE CONTENT

- Determine the organizational pattern of a passage, but not label the pattern. (Note: Organizational patterns may include chronological order, spatial order, order of importance, comparison and contrast, cause and effect, and main idea with examples or anecdotes.)

SAMPLE ITEMS

The item below references "Flight Simulator" on page 31.

1 In the section titled "HOW I GOT STARTED," information is organized by

A date.

B skill.

* **C** time.

D importance.

The item below references "From Points to Periods" on page 39.

2 How is the information in this article organized?

* **A** events presented in the order they occurred

B general statements clarified by specific examples

C overall descriptions followed by detailed analyses

D definitions supported through references to authorities

The item below references "Park It" on page 24.

3 How are the first and second parts of this brochure different?

* **A** The first part promotes the features of parks; the second part lists factual information.

B The first part lists sequential details; the second part promotes the highlights of parks.

C The first part lists details; the second part contains chronological information about parks.

D The first part contains chronological information about parks; the second part describes various features.

The item below references "Postal Delivery Time Line" on page 19.

4 This time line is organized according to

* **A** when the events happened.

B where the events happened.

C the importance of the events.

D the people involved in the events.

The item below references "Point of View on Advertising" on page 36.

5 How is this editorial organized?

A main idea supported by statistical examples

* **B** critical ideas contradicted by logical statements

C a number of topics introduced for further development

D a number of topics considered, all of historical significance

The item below references "Video Game Designer" on page 28.

6 Information in the article is organized according to

A isolated blocks of information.

* **B** separate sections with headings.

C steps explaining how to enter the field.

D important events in the author's career.

The item below references the paragraph and bus schedule "Buses Leaving Mobile" on page 44.

7 The bus schedule presents information in

A related blocks of places and times.

* **B** separate columns with headings.

C steps telling how to buy a ticket.

D interesting sites to see en route.

The item below references the paragraph and bus schedule "Buses Leaving Mobile" on page 44.

8 The information in the bus schedule is organized by

A bus numbers numerically ordered.

B transfer places ordered by distance.

C destinations alphabetically ordered.

* **D** departure times chronologically ordered.

STANDARD IV: The student will utilize strategies that enhance comprehension of textual, functional, and recreational reading material.

OBJECTIVE

4. Demonstrate the ability to locate information in reference material.

ELIGIBLE CONTENT

- Comprehend information in reference materials. (Note: Reference materials may include glossaries; dictionaries; indexes; tables of contents; appendixes; and research sources such as atlases, almanacs, encyclopedias, readers' guides, and both print-based and electronic card catalogs.)

SAMPLE ITEMS

The item below references "Park It" on page 24.

1 Which park has shower facilities?

A Fort Barrancas
B Naval Live Oak Reservation
C Blackwater River State Park
* **D** Perdido Key Area Johnson Beach

The item below references "The Terms of Trade" on page 21.

2 Jesse decides to support his paper's arguments with concrete examples of countries that are putting free trade agreements into practice. Which heading should Jesse first research at the library?

A Tariffs
* **B** NAFTA
C Globalization
D Protectionism

The item below references "The Terms of Trade" on page 21.

3 What is the BEST way for Jesse to locate countries that have recently established trade barriers?

* **A** by gathering information from the WTO
B by researching the history of the GATT
C by discovering more facts about free trade
D by investigating the theory of globalization

The item below references "The Terms of Trade" on page 21.

4 A tax on imported products is called

* **A** a tariff.
B a quota.
C an export.
D a trade barrier.

The item below references "The Terms of Trade" on page 21.

5 Products that are brought from another country and used domestically are called

A tariffs.

B quotas.

C exports.

* **D** imports.

The item below references "The Terms of Trade" on page 21.

6 What is the trend toward a worldwide market that has no national boundaries called?

A free trade

B trade barriers

* **C** globalization

D protectionism

The item below references "The Terms of Trade" on page 21.

7 Jesse wants to trace the movement toward a worldwide market. He wants to include the resolution of recent trade conflicts in his research paper. Under which heading should Jesse look?

* **A** WTO

B GATT

C Protectionism

D Trade barriers

The item below references the paragraph and bus schedule "Buses Leaving Mobile" on page 44.

8 What is the number of the bus that will make the most stops before reaching its final destination?

A 46

B 498

* **C** 575

D 109

The item below references the paragraph and bus schedule "Buses Leaving Mobile" on page 44.

9 What is the number of the bus that stops in Montgomery, Alabama, before it reaches its final destination?

* **A** 498

B 73

C 575

D 109

The item below references the paragraph and bus schedule "Buses Leaving Mobile" on page 44.

10 To which of the following cities is there a nonstop bus from Mobile?

A Dalton, GA

* **B** Glasgow, KY

C Lexington, KY

D Carbondale, IL

The item below references the paragraph and bus schedule "Buses Leaving Mobile" on page 44.

11 What can you determine about the buses labeled "EXPRESS"?

A These buses drive faster.

B These buses don't cost as much.

C These buses carry more passengers.

* **D** These buses don't make any stops.

The item below references the paragraph and bus schedule "Buses Leaving Mobile" on page 44.

12 What time does the bus to Carbondale, IL, leave Mobile?

A 10:01 a.m.

B 10:15 a.m.

C 12:30 p.m.

* **D** 3:25 p.m.

The item below references the paragraph and bus schedule "Buses Leaving Mobile" on page 44.

13 A friend asks Timothy which bus to take to travel from Mobile to Montgomery. What is the number of the bus he should take?

A 46

* **B** 498

C 73

D 109

ANSWER KEY

ANSWER KEY FOR PASSAGES WITH ITEMS

"Dorothy Parker"
1. D
2. A
3. D
4. B
5. B
6. B
7. A
8. D
9. D

"In and of Ourselves We Trust"
1. B
2. C
3. C
4. C
5. A
6. A
7. B

"Just Two Points Make One Dream Come True"
1. A
2. A
3. A
4. D
5. C
6. D
7. B
8. B

"Saga of a Seagoing Dog"
1. C
2. C
3. B
4. C
5. A
6. B
7. D
8. B
9. D
10. B

"Postal Delivery Time Line"
1. A
2. C
3. D
4. B
5. A
6. D

"The Terms of Trade"
1. A
2. B
3. B
4. A
5. A
6. D
7. C
8. C

"Park It"
1. C
2. D
3. D
4. A
5. C
6. B
7. D
8. A
9. C
10. C

"Video Game Designer"
1. B
2. B
3. C
4. D
5. B
6. D
7. D

"Flight Simulator"
1. D
2. D
3. A
4. C
5. D
6. D
7. C
8. C
9. D

"Pollution's Hidden Toll on Native Plants"
1. C
2. B
3. C
4. B
5. B
6. B
7. A
8. A
9. C

"Point of View on Advertising"
1. B
2. C
3. D
4. B
5. D
6. A
7. C
8. C
9. D
10. C
11. C

"From Points to Periods"
1. B
2. A
3. A
4. A
5. D
6. B
7. B
8. A

"The Globe Theater"
1. A
2. D
3. A
4. A
5. D

"Buses Leaving Mobile"
1. C
2. A
3. B
4. D
5. D
6. B
7. D
8. B